

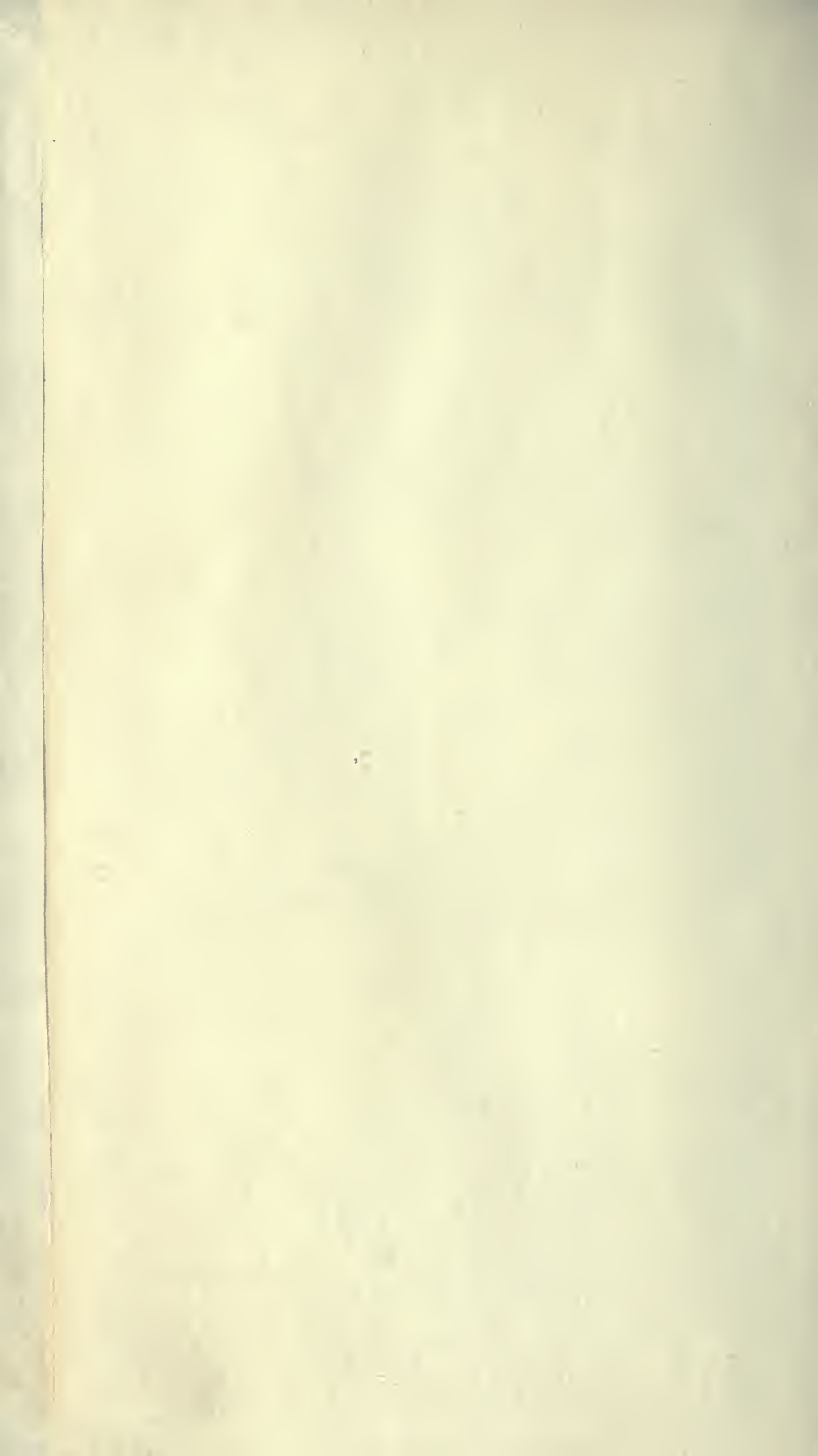




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THIS volume completes the octavo series of the "Journal." The second series will appear in quarto form, under the title:—"Memoirs read before the Boston Society of Natural History."

*Publishing Committee.*

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BOSTON

# JOURNAL OF NATURAL HISTORY.

VOLUME VII.—NO. I.

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ART. I.—*A Supplement to the "Terrestrial Mollusks of the United States, &c."* By W. G. BINNEY.<sup>1</sup>

THE following pages are devoted to a continuation of the work of my father on the Terrestrial Mollusks of the United States. They are believed to contain all the latest information regarding the several species, their varieties, synonymy, geographical distribution, &c. I have also added many references to authors not quoted in the Mollusks, as well as to those whose works have appeared more recently. Descriptions of all the newly discovered species are added, and figures given of all to which I have been able to obtain access.

Since no species was described in the "Mollusks," with which the author or the able editor was not personally acquainted, there were quite a number of doubtful species entirely omitted in that work. These I have added, with all the information in regard to them which I have been able to obtain.

In addition to the species recently discovered, there are many shells which have been described as distinct species during the last twelve years, though considered as only

<sup>1</sup> The plates are numbered in continuation of those in the third volume of the "Terrestrial Mollusks," by Dr. Amos Binney; as the paper forms a continuation of that work.

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varieties of other species by Dr. Binney. In treating these, I have followed the opinions of the latest writers, founded on the advanced state of our knowledge of this department of science.

In all doubtful cases, I have given the original description and figure of the authors whose opinions conflict, often reserving my own decision till more information has been obtained. I have also endeavored to increase the usefulness of my work by adding many descriptions and figures from rare and generally inaccessible works.

The measurements of the shells described are the same as adopted by Dr. Pfeiffer, and are given in the millimetre, which is equal to  $\frac{1}{25}$  of an inch. I have also followed Dr. Pfeiffer in the systematic arrangement of the various genera.

The species of the Western Coast are grouped separately. I have described only those which have actually been found within the limits of the United States, though I have added the names of all the extra limital species found north of Mazatlan. In the second division of the work, I have included the species inhabiting the whole continent of North America, from the boreal regions to the Rio Grande.

I would take this opportunity of returning thanks to the numerous friends who have aided my studies by furnishing me specimens and interesting information regarding the species of their vicinity. I am particularly indebted to my friend Thomas Bland, Esq., of New York, for the use of his most interesting collection of American land shells, as well as for the great advantage I have derived from his valuable assistance during the four years I have devoted to the following pages. To Mrs. Thomas Say, also, I am under very great obligations for the use of her husband's MSS. and many letters from Fenessac and other conchologists. Many of Say's types, preserved in

the Philadelphia Academy, have been consulted by me, as well as those of my father which are in my own collection.

I have endeavored to include all the information on this subject which has been published prior to January 1st, 1859. In subsequent supplements I shall endeavor to present all the additional information elicited by future research. To this end, criticisms on the opinions I have advanced are solicited, and suites of local species from every part of the country.

The Auriculacea and the Aciculacea of the United States are added to the families described in the "Mollusks." This first attempt to describe them has been attended by many disadvantages, and is offered with great hesitation as necessarily quite incomplete.

Burlington, N. J., August, 1859.

The following list contains the additional works referred to in the text.

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## I. THE SPECIES OF THE PACIFIC COAST.

## FAMILY LIMACEA.

## GENUS ARION FERUSSAC.

**ARION FOLIOLATUS** GOULD.....vol. ii. p. 30, pl. lxvi. fig. 2.*Arion foliolatus* GOULD, Ex. Ex. p. 2, fig. 2 a b.

## GENUS LIMAX FERUSSAC.

**LIMAX COLUMBIANUS** GOULD.....vol. ii. p. 43, pl. lxvi. fig. 1.*Limax Columbianus* GOULD, Ex. Ex. p. 3, fig. 1 a b c.

## FAMILY HELICEA.

## GENUS SUCCINEA DRAPANAUD.

**SUCCINEA NUTTALLIANA** LEA.....vol. ii. p. 81, pl. lxvii. a, fig. 2.*Succinea Nuttalliana* LEA, Tr. Am. Phil. Soc. ix. p. 4.

PFEIFFER, Mon. Hel. Viv. ii. 523; iii. 15.

**SUCCINEA OREGONENSIS** LEA.....vol. ii. p. 77, pl. lxvii. c, fig. 2.*Succinea Oregonensis* LEA, Tr. Phil. Soc. ix. p. 1, p. 5, (1844).

PFEIFFER, Mon. Hel. Viv. ii. 523; iii. 15.

**SUCCINEA RUSTICANA** GOULD.

## PLATE LXXIX. FIGURE 14.

*T. elongata*, ovato-conica, tenuis, pallidè virens, impolita, lineis inequalibus incrementalibus et crassis striata, subtus convexa; spira acuta, anfr. 3 convexiusculis; apertura ovata, quadrantes tres longitudinis adequans; columellâ arcuatâ, perspicuè plicatâ. (Gould).

## SYNONYMS AND REFERENCES.

*Succinea rusticana* GOULD, Pr. Boston Soc. Nat. Hist. ii. 187, Dec. 1846; Expedition Shells, 31; Mollusca of Exploring Ex. p. 28, fig. 29, 1852.

PFEIFFER, Mon. Hel. Viv. ii. 523; iii. 15.

## DESCRIPTION.

*Shell* elongate, ovate conical, rather large, thin and fragile; pale greenish horn color, surface rude and without lustre, coarsely and

irregularly marked by the lines of growth. Spire acute, of three or more moderately convex whorls, separated by a well impressed suture, the last whorl large and long, narrowing towards the base; body portion of the face of the shell moderately large. Aperture ovate, three fourths the length of the shell; fold of the columella distinct.

Length of axis  $\frac{1}{2}$ , breadth  $\frac{1}{4}$  inch.

*Geographical Distribution.* Oregon.

*Remarks.* Somewhat allied to *S. pudorina* in form, but very different in color. (Gould).

I have not seen this species. The above is Gould's description. The figure I have given is a fac-simile of the outline of the figure referred to above.

#### EXTRA LIMITAL SPECIES.

*Succinea cingulata* Forbes, from Mazatlan, is described in the Proceedings of the Zoölogical Society, 1850, p. 56.

#### SPURIOUS SPECIES.

*Succinea aperta* Lea, vid. vol. ii. p. 67.

#### GENUS HELIX LINNÆUS.

**HELIX TUDICULATA** BINNEY.....vol. ii. p. 118, pl. xvi.

*Helix tudiculata* PFEIFFER, Mon. Hel. Viv. i. 283.

Pfeiffer (l. c.) repeats Binney's description, not having seen the shell, and suggests doubtfully its being a variety of *H. Californiensis*.

**HELIX NICKLINIANA** LEA.....vol. ii. p. 119, pl. vi. a.

*Helix Nickliniana* TROSCHER, Arch. für Nat. 1839, ii. 221.

*Helix Californiensis* CHEMNITZ, ed. 2, p. 332, pl. lvii. fig. 14-15, Excl. var. 2, (1846).

REEVE, No. 661.

PFEIFFER, Mon. Hel. Viv. i. 339; iii. 229.

*Helix arboretorum* VALENCIENNES, Voy. de la Venus. Moll. pl. i. fig. 3.

*Helix nemoraviga* VALENCIENNES, l. c. fig. 1.

"*Animal* reddish gray, tentacles and base of foot bluish; quite

narrow in proportion to the length of the shell; tentacles short. Gregarious, inhabiting dry gullies and hill sides; many specimens found in a cabbage garden." (Thomson).

This shell varies very considerably in size and in the elevation of its spire. This fact will account for the difference in the figures referred to in the synonymy. That of pl. vi. a, is a perfect representation of what Lea's original specimen would be in a fresh state.

*Helix Californiensis* of Pfeiffer, Chemnitz, and Reeve, are to be referred to this species. Those authors are incorrect in considering *H. Nickliniana* a variety of *H. Californiensis*.

*H. arboretorum* is placed by Pfeiffer doubtfully in the synonymy of *H. Californiensis*, while *H. nemoraviga* is placed among the uncertain species. A fac-simile of Valenciennes's figure of the former is given, pl. 76, fig. 13, and of the latter on pl. 79, fig. 11.

I have described, under the names of *H. redemita* and *H. intercisa*, the shells figured on pl. vi. as varieties of this species.

#### HELIX INTERCISA.

PLATE VI. FIGURE 1. Middle figure.

Testa solidissima, luteo-cinerea, apice rufâ, globoso-conica; spira brevis; sutura impressa; anfractus quinque, convexiusculi, lineis parallelis volventibus, valdè demissis, strias incrementales distinctas intercidentibus notati; anfr. ultimus globosus, supra peripheriam fasciâ unicâ, rufâ obscurissimâ ornatus; apertura maximè obliqua, formâ equi calcei, rotundata; labrum albo-cinereum, incrassatum, subtus reflexiusculum, subunidentatum, umbilicum totum tegens; marginibus approximatis, callo interjunctis.

#### SYNONYMS AND REFERENCES.

- Helix intercisa* W. G. BINNEY, Proc. Acad. N. S. Phila. ix. p. 18, (Oct. 1857);  
Proc. Boston Soc. N. H. vi. p. 156; Notes, p. 1.  
*Helix Nickliniana* var. BINNEY, Terrestrial Mollusks, ii. p. 120; iii. pl. vi. f. 1.  
*Icon in medio posita.*



## DESCRIPTION.

*Animal* not observed.

*Shell* globose-conic, with five slightly-rounded whorls; spire little elevated; suture distinct; upon the body whorl a dark revolving band, hardly discernible; aperture very oblique, shape of a horseshoe; peristome thickened, heavy, dirty white, slightly reflected at the umbilicus, which it entirely conceals, near its junction with the columella furnished with a tooth-like process, the extremities connected by a heavy ash-colored callus, which is spread more lightly over the whole parietal wall; epidermis grayish yellow, apex rufous. The striæ of growth are very numerous and distinct, crossed by numerous, regular, revolving lines, so deeply impressed as to entirely separate them into small sections; thus the whole surface of the shell is divided into minute, raised parallelograms, separated by the deep longitudinal and horizontal furrows.

Greatest diameter, 22; lesser, 19; alt. 15 millimetres.

*Geographical Distribution.* Found in Oregon Territory.

*Remarks.* This shell I found in the collection of my father. It was labelled *H. Nickliniana* Lea, var., and as such is figured in the Terrestrial Mollusks. I cannot believe, however, that any species can admit of varieties differing so much as this does from *Nickliniana*. To Mr. Lea's figure and description it bears no resemblance whatever, either in shape or sculpturing.

It may readily be distinguished among the *Helices* of the Pacific coast, by its grayish, heavy shell, its thickened lip, and above all, by the peculiar markings of the surface.

## HELIX REDEMITA.

## PLATE VI. FIGURE 1.

Testa globoso-conica, imperforata, tenuiscula, minutè et confertim granulata, corrugata, rufo-brunnea; apex lævigata, obtusula, spira elevata; anfr. 6 convexi, suturâ impressâ distincti, ultimus permagnus, inflatus, ad

aperturam descendens, supra medium fasciâ fuscâ redimitus; apertura perobliqua, transverso-orbicularis, intus unifasciata; perist. simplex, rufo-cinereum, incrassatum, marginibus valde approximatis, basali reflexiusculo, callo albo umbilicum tegente.

## SYNONYMS AND REFERENCES.

*Helix redimita* W. G. BINNEY, Proc. Acad. Nat. Sc. of Phila. vol. ix. p. 183, Notes, p. 3, Oct. 1857.

*Helix Nickliniana* var. BINNEY. Terr. Moll. iii. pl. vi. fig. 1, (exceptâ icone in medio positâ) 1857.

## DESCRIPTION.

*Animal* not observed.

*Shell* globose-conic, imperforate, rather thin, wrinkled, covered with minute and crowded granulations; color reddish brown; apex free from granules, rather blunt; spire elevated; suture impressed; whorls six, convex, the last quite large and rounded, falling towards the aperture, and banded with reddish brown above the middle; aperture rather large in proportion to the size of the shell, very oblique, transversely rounded, within showing the band; peristome simple, reddish ash color, thickened, reflected slightly at the base, ends approached; umbilicus entirely covered with a white callus.

Greater diameter, 31; lesser, 17; height, 12 mill.

*Geographical Distribution.* I am not acquainted with the exact locality of this shell, but am inclined to refer it to California.

*Remarks.* This shell is figured by my father as a var. of *H. Nickliniana* Lea. A reference to Mr. Lea's figure and description will at once show it to be distinct, according to the present notions of specific weight. Dr. Gould refers it (Terr. Moll. iii. p. 26) to *H. Californiensis* Reeve, (Con. Icon. 661). It appears, however, to be distinct from the shell there figured.

In general outline it resembles *H. Kellettii* Forbes, Proc. Zool. Soc. London, 1850, pl. ix, f. 2, as well as Reeve's

fig. 665 *b*, not 665 *a*, Con. Icon. The resemblance will be found, however, to cease with the outline, on a comparison of the two shells. *H. Kellestii* is sometimes perforate, is differently colored, and belongs rather to the group of California *Helices* represented by *H. areolata* Sowb. and *H. Pandoræ* Forbes, than that of *H. Californiensis* Lea, *intercisa*, nob. and the shell before me.

### HELIX ANACHORETA.

PLATE LXXVI. FIGURE 5.

T. orbiculato-convexa, apertè umbilicata, cinereo-rufescens, granulata et rarè indenta; spira elevata, conica; anf. 6 convexi, ultimus subtus ventricosus; sutura impressa; perist. incrassatum, vix reflexiusculum, violaceo-albidum, umbilicum haud multum occultans, marginibus approximatis, callo conjunctis; faux violacea; apertura obliqua, transverso-rotundata.

#### SYNONYMS AND REFERENCES.

*Helix anachoreta* W. G. BINNEY, Proc. Acad. Nat. Sc. of Phila. ix. p. 185, Notes, p. 5, Oct. 1857.

#### DESCRIPTION.

“*Animal* light ashen color, tentacles nearly white; average length of some thirty specimens  $2\frac{1}{2}$  inches (2 diameters of shell); superior tentacles 5-8ths; inferior 3-16ths inch; foot broad at the posterior extremity; a line of large granules down the middle of the back; sides of foot margined with a line of light granules (pores); genital orifice posterior to and beneath the larger tentacles. In its habits solitary.” (Thomson.)

*Shell* reddish ashen, orbicularly convex; spire elevated, conic; umbilicus open, slightly concealed by the peristome; whorls six, granulated and sparsely indented; suture impressed; below ventricose; aperture transversely rounded; peristome thickened, scarcely reflected, whitish, with a violet tinge, the extremities approaching each other

and connected with a callus on the parietal wall; throat violet.

Greater diameter, 26; lesser, 21; height, 14 millimetres.

*Geographical Distribution.* Found by Mr. J. H. Thomson widely distributed in California.

*Remarks.* It was with some hesitation that I proposed a name for this shell. I at first considered it as a bandless variety of *Nickliniana* Lea. But on expressing this opinion to Mr. Thomson, he gave me the above description of the animal and its habits, which are quite distinct from those of Mr. Lea's shell. Its characteristics were found constant at various remote points of the State, and in a considerable number of specimens. They seem too great for a simple variety. The animal is also different in its habits from *Nickliniana*, being found only solitary, while the latter is gregarious.

The shell is one of the very few bandless species of California.

#### HELIX RETICULATA PFEIFFER.

T. umbilicata, globoso-depressa, solidula, oblique striata, striis subregulariter antrorsum descendentibus oblongo-granulata, fulvida, fascia 1 rufa peripheria cincta; spira breviter conoidea; anfr.  $5\frac{1}{2}$  convexiusculi, ultimus latus, rotundatus, antice non descendens; umbilicus angustus, non pervius; apertura diagonalis, rotundato-lunaris; perist. crasse albo-labiatum, marginibus distantibus, dextro vix expansiusculo, columellari declivi superne dilatato, reflexo.

Diam. maj. 22, min. 18, alt.  $11\frac{1}{2}$  mill. Hab. in California.

(Pfeiffer, Malak. Blätt. 1857, p. 87.)

I have not seen this species. The above is Pfeiffer's description.

#### HELIX EXARATA PFEIFFER.

T. umbilicata, conoideo-depressa, solidula, undique malleato-rugulosa, lutescens, fasciâ 1 castaneâ cincta; spira breviter conoidea, acutiuscula; anfr. 7 parum convexi, lente accrescentes, ultimus latior, rotundatus,



antice vix decedens, circa umbilicum mediocrem, apertum subcompressus; apertura obliqua, latè lunaris; perist. leviter albo-labiatum, marginibus vix convergentibus, dextro breviter expanso, columellari superne triangulatim dilatato, patente. [Pf.]

## SYNONYMS AND REFERENCES.

*Helix exarata* PFEIFFER, Proc. Zool. Soc. of London, May, 1857, p. 108.

Diam. maj. 30, min. 25, alt. 16 mill. Hab. California? (Pf.)

I have not seen this species. The description given above is Pfeiffer's.

**HELIX CALIFORNIENSIS** LEA.....vol. ii. p. 121, pl. vi. fig. 2.

*Helix Californiensis* TROSCHEL in Wieg. Arch. 1839, ii. 221.

DEKAY, N. Y. Moll. p. 46, — not of Pfeiffer, Chemnitz, Reeve.

*Helix vineta* VALENCIENNES, Voy. de la Venus, Moll. pl. 1, fig. 2, absq. desc.

CHEMNITZ, ed. 2, vol. ii. p. 487, t. 160, fig. 2 (1854).

REEVE, Con. Icon. No. 660.

PFEIFFER, Mon. Hel. Viv. iii. 183.

W. G. BINNEY, Notes, p. 9.

In my notes No. 2, I expressed the opinion that *H. vineta* figured by Valenciennes was distinct from this species. Having since carefully compared Lea's original specimen with Valenciennes's figure, I am convinced of their identity. The figure in the Terrestrial Mollusks is a correct representation of this species in a fresh state. Reeve's figure 660 is also good. That of Chemnitz (l. c.) is less characteristic. Lea's figure is very poorly drawn, and at best represents a dead and worn specimen.

Under the name of *H. vineta*, therefore, descriptions and figures of *H. Californiensis* are to be found in the works referred to in the synonymy. All other descriptions and figures referred to *Helix Californiensis* represent *Helix Nickliniana*, including those given in Chemnitz, Pfeiffer, and Reeve.

**HELIX RAMENTOSA** GOULD.....vol. iii. p. 12.

**HELIX LORICATA** GOULD.....vol. ii. p. 145, pl. xxix a. fig. 2.*Helix loricata* GOULD, U. S. Ex. Ex. Moll. p. 68, fig. 39, a. b. c.

PFEIFFER, Mon. Hel. Viv. iii. p. 265.

*Helix Lecontii* LEA, Tr. Am. Phil. Soc. vol. x. No. 2, p. 303, pl. xxx. fig. 13 (1852).

PFEIFFER, l. c. iii. p. 265.

From an examination of Lea's original specimen of *Lecontii*, as well as from his description and figure, I am convinced of its identity with *loricata*. Gould expresses this opinion (Ex. Ex. p. \*501, Addenda), Pfeiffer copies Lea's description, not having seen the shell, and remarks "Nonne varietas umbilicata *H. pustulæ*?"

"Animal white, linear, rough, posteriorly acute, tentacles very short." (Thomson.)

The shell is furnished with the peculiar internal fulcrum mentioned by Lea, (l. c.)

**HELIX GERMANA** GOULD.....vol. ii. p. 156, pl. xla. fig. 3.\**Helix germana* GOULD, U. S. Ex. Ex. Moll. p. 70, fig. 40 a. b. c.

PFEIFFER, Mon. Hel. Viv. iii. 269.

**HELIX FIDELIS** GRAY.....vol. ii. p. 159, pl. xviii.*Helix fidelis* MÜLLER, Syn. Test. anno 1834 promulgatorum, p. 8.

CHEMNITZ, ed. 2, vol. i. 321, pl. lvii. fig. 12 - 13 (1846).

REEVE, Con. Icon. No. 657 (1852).

W. G. BINNEY, Pac. R. R. Rep. vi. p. 111 (1857).

PFEIFFER, l. c. iii. 229.

*Helix Nuttalliana* TROSCHEL, Arch. für Nat. 1839, ii. 229.

GOULD, U. S. Ex. Ex. Moll. p. 65, fig. 38 (1852).

All the more recent writers agree in placing *H. Nuttalliana* in the synonymy of *H. fidelis*, excepting Gould, who, as late as 1852, (l. c.) remarks, "As there are other species in that region corresponding equally well with Gray's indefinite description, I think it proper to retain Mr. Lea's name until the identity can be fully settled."

\* On the copy of the plate referred to, engraved by Delarue, the aperture of *Helix maxillata* is erroneously placed next the figure of this species. This mistake does not occur on the other copy of the plate.

**HELIX INFUMATA** GOULD.....vol. iii. p. 13, pl. lxxix. fig. 2.

*Helix infumata* W. G. BINNEY, Pac. R. R. Rep. vi. p. 112.

**HELIX TOWNSENDIANA** LEA.....vol. ii. p. 161, pl. xix.

*Helix Townsendiana* TROSCHEL, Arch. für Nat. 1839, ii. 221.

CHEMNITZ, ed. 2, i. 323, pl. lvii. fig. 10, 11 (1846).

REEVE, Con. Icon. 625 (1852).

PFEIFFER, l. c. iii. 229.

GOULD, U. S. Ex. Ex. Moll. 67, fig. 36.

**HELIX ARROSA** GOULD.....vol. iii. p. 12, pl. lxxvi. fig. 4.

*Helix æruginosa* GOULD, l. c.

W. G. BINNEY, Pac. R. R. Rep. vi. p. 113.

*Helix arrosa* GOULD in litt.

W. G. BINNEY, Notes, p. 5.

This name is proposed by Gould in place of *æruginosa*, that being preoccupied.

**HELIX DUPETITHOUARSI** DESHAYES...vol. iii. p. 14, pl. lxxvi. fig. 9.

*Helix Dupetithouarsi* DESHAYES, in Fer. i. 169, pl. xcvii. fig. 8-10.

REEVE, Con. Icon. 659 (1852).

PFEIFFER, l. c. Excl. var. B.; iii. 229.

W. G. BINNEY, P. R. R. Rep. vi. p. 114.

*Helix Oregonensis* TROSCHEL, Arch. für Nat. 1839, ii. 221.

DEKAY, N. Y. Moll. 46.

PFEIFFER, l. c. iii. 272.

In the collection of the Smithsonian Institute there are specimens of this shell which are furnished with a delicate greenish-yellow epidermis. As this has never been noticed in descriptions, I believe it must exist only on very fresh specimens, which are rarely seen. On being immersed some minutes in water, the epidermis becomes of a bright golden color.

The figure is a fac simile of that of Deshayes.

#### **HELIX MORMONUM** PFEIFFER.

PLATE LXXIX. FIGURE 21.

T. umbilicata, depressa, tenuiscula, arcuato-striatula, pallide rufescens; spira vix conoideo-elevata; anfr. 6, vix convexiusculi, lente ac-

crecentes, ultimus utrinque convexior, antice turgidulus, vix descendens, supra medium fasciâ castaneâ, utrinque albido-marginatâ cinctus, basi convexus; umbilicus mediocris, conicus; apertura perobliqua, auriformi, lunaris; perist. albo-labiatum, marginibus convergentibus, dextro perarcuato, expanso, columellari arcuato-declivi, reflexo, superne dilatato. [Pf.]

## SYNONYMS AND REFERENCES.

*Helix Mormonum* PFEIFFER, Proc. Zoöl. Soc. London, May, 1857, p. 109.

Diam. maj. 29, min.  $24\frac{1}{2}$ , alt.  $12\frac{1}{2}$  mill. *Hab.* Mormon Island, California. (Pf.)

The above is Pfeiffer's description. I have not seen the shell, but through the kindness of Mr. Cuming I have been able to give a figure of it.

**HELIX COLUMBIANA** LEA.....vol. ii. p. 169, pl. v. pl. xiii. a. fig. 1.

*Helix Columbiana* TROSCHEL, Arch. für Nat. 1839, ii. 221.

CHEMNITZ, ed. 2, i. 332, pl. lviii. fig. 10-12 (1846).

REEVE, Con. Icon. No. 692 (1852).

PFEIFFER, l. c. iii. 262.

*Helix labiosa* GOULD, vol. ii. p. 170; U. S. Ex. Ex. Moll. p. 67, fig. 35.

PFEIFFER, l. c. p. 262.

I think there can be no doubt of the identity of these two species. Lea's description was drawn from a worn specimen, denuded of its hairs. It will be remarked that Reeve and Pfeiffer describe it as being covered "pilis brevibus." The latter author gives Gould's description of *labiosa*, not having seen the shell, but records his belief in the identity of the two.

Mr. Thomson gives me the following note on the animal of this species. It seems more than probable that he has confounded it with some other shell, as his observations do not agree with those given on p. 171 (vid. Notes, p. 8).

"Animal twice as long as the breadth of the shell, dark slate color, almost black on the head and tentacles; a black line running along each side of the back from the base of the longer tentacles; body covered with com-



pressed granules; tentacles black, acutely pointed; *eyes at the base of superior tentacles*; anatomy believed to resemble, somewhat, that of the Lymniadæ. Gregarious; in its habits resembling Lymnæa, being found always near water, and laying its eggs on the water-cresses and other aquatic plants. Arrives at maturity in one year, one half the time required by the other species."

**HELIX DEVIA** GOULD.....vol. iii. p. 11, pl. lxxix. fig. 13.

*Helix devia* PFEIFFER, l. c. iii. 262.

GOULD, Addenda, Ex. Ex. \*501.

*Helix Baskervillei* PFEIFFER, l. c. iii. 230.

There can be no doubt of the identity of these two species. Gould's original specimen agrees perfectly with the figure of Reeve (l. c.) and Pfeiffer's description. The latter remarks on *H. Baskervillei* "Conf. *H. devia* Gould, huic forsan peraffinis."

The shell figured is preserved in the Cumingian collection.

#### **HELIX KELLETTI FORBES.**

PLATE LXXVI. FIGURE 12.

*H. testa angustè umbilicata, depresso globosâ, tenui, rugulosâ, granulatâ, fulvâ, spirâ subturbinatâ, sordidè flavo conspersâ, rufo-unifasciatâ, anfr. 6 convexiusculi, ultimo ad peripheriam fasciâ pallidâ cincto, basi subinflato; aperturâ lunato-rotundatâ, intus pallidè fuscâ, unifasciatâ; perist. reflexiusculo, margine columellari dilatato, reflexo, umbilicum occultante. Diam. max. 22, min. 19, alt. 19 mill.*

This species is nearly allied to *H. Californiensis* Lea. It differs in the more pyramidal contour of the spire, in the less tumid body whorl, and consequently differently shaped, more lunate, slightly elongated mouth. The margin of the mouth is more reflected. [Forbes.]

#### SYNONYMS AND REFERENCES.

*Helix Kelletti* FORBES, Proc. Zool. Soc. London, 1850, p. 55, pl. ix. fig. 2 a. b.

REEVE, Con. Icon. No. 665, (1852).

CHEMNITZ, ed. 2, ii. 467, pl. clvi. fig. 19, 20, (1853).

PFEIFFER, Mon. Hel. Viv. iii. 183.

Not possessing a fresh specimen of this species, I am not able to add a more detailed description to that of Forbes, repeated above. My figure is a fac-simile of his. In Gould's collection is a specimen said to have been found at San Diego. The species has been attributed to Central America, but probably through some error.

Reeve's figure *b* seems more closely allied to *H. areolata* or *H. levis*, than to the form figured by Forbes.

**HELIX PANDORÆ** FORBES. ....vol. iii. p. 15, pl. lxxvi. fig. 8.

*Helix Pandoræ* REEVE, Con. Icon. No. 671, (1852).

CHEMNITZ, ed. 2, ii. 467, pl. 156, fig. 17, 18, (1853).

PFEIFFER, Mon. Hel. Viv. iii. 127.

Reeve gives as habitat "Central America."

The figure given is a fac-simile of the original. I have not seen the shell. Below is Gould's description of *damascenus*.

**HELIX DAMASCENUS.** T. conico-globosa, imperforata, solidula, dilutè prunina ad apicem violacea subtus cinerascens, rudis et lineis tenuibus interruptis numerosis cincta; anfr. 5 rotundatis; suturâ impressâ: apertura subcircularis; peristomate angustè reflexo, pallido, extremitatibus approximatis; fauce lividâ; columellâ incrassatâ, rotundatâ.

#### **HELIX LEVIS** PFEIFFER.

PLATE LXXVI. FIGURE 10.

Testa perforata, globosa, tenuis, levis, oblique striata, obsolete granulata, albida, punctis seriatis vel fasciis pellucide corneis varie ornata; spira brevis, acutiuscula; anfr. 5 vix convexiusculi, ultimus inflatus; apertura rotundato-lunaris, intus concolor vel fulvida; perist. acutum, intus sublabiatum, margine columellari superne dilatato, fornicatim reflexo, perforationem fere tegente. Diam. maj. 16, min. 14, alt. 13 mill.

β. Margine columellari dente unico, obtuso, calloso instructo.

Habitat in Californiâ, ad Columbia River. [Pfeiffer].

*Helix levis* PFEIFFER, Mon. Hel. Viv. i. 154; iii. 128. Zietschr, f. Mal. 1845, p. 152.

CHEMNITZ, ed. 2, i. 249, pl. xxxvi. f. 16, 17, (1846).

I have not seen this species. Pfeiffer's description is

given above, and a fac-simile of his figure in the second edition of Chemnitz is given on the plate referred to.

**HELIX AREOLATA** SOWERBY, . . . vol. iii. p. 14, pl. lxxvi. fig. 11; var.  $\gamma$ . fig. 3.

*Helix areolata* PFEIFFER, l. c. iii. 127.

CHEMNITZ, l. c. 1, 248, (1846).

REEVE, Con. Icon. No. 664, (1852).

The original figure of Pfeiffer is copied on the plate referred to from Chemnitz, edition 2. Two varieties are mentioned by him.

" $\beta$ . Dente aperturæ obsoleto.

" $\gamma$ . Minor, globosa, dente aperturæ valido." (fig. 3).

**HELIX VANCOUVERENSIS** LEA, . . . . . vol. ii. p. 166, p. xx.

*Helix Vancouverensis* TRÖSCHEL, Ar. f. Nat. 1839, ii. 221.

PFEIFFER, l. c. iii. 155.

CHEMNITZ, ed. 2, ii. 146, pl. xciv. f. 21-23.

GOULD, U. S. Expl. Ex. p. 36, fig. 37.

REEVE, Con. Icon. No. 669 (1852).

*Helix vellicata* FORBES, Proc. Zool. Soc. London, Mar. 1850, p. 75, pl. ix. fig. 1:

CHEMNITZ, ed. 2, ii. 454, pl. cliv. fig. 42-44.

REEVE, Con. Icon. No. 673, (1852).

PFEIFFER, Mon. Hel. Viv. iii. 155.

From the description and figure of Forbes, as well as from specimens received from Mr. Cuming's collection, I am satisfied of the identity of *H. vellicata* with this species. Forbes's description is given below.

H. t. apertè umbilicatâ, tenui, convexo-depressâ, subnitidâ, sulcato-striatâ, striis minutissimis spiralibus decussatâ, læte viridibus; spirâ convexiusculâ, anfr. 6, ultimo rotundato, magno, anticè dilatato, subdescendente; ap. perobliquâ, lunato-oblongâ; faux alba, perist. margine subreflexo, supernè deflexo-sinuato. Diam. max. 22, min. 18, alt. 8 mill.—Panama?

Distinguished from its near allies by the peculiar deflection of the upper portion of the lip margin.

**HELIX SPORTELLA** GOULD, . . . . . vol. ii. p. 211, pl. xxii a. fig. 1.

*Helix sportella* GOULD, U. S. Expl. Ex. p. 37, fig. 42.

PFEIFFER, l. c. iii. 104.

The revolving striæ appear to be wanting in some indi-

viduals. In the mature shell the peristome is slightly reflected, and has the remarkable deflection which characterizes *H. Vancouverensis* and *H. concava*.

Found at San Diego by Dr. J. S. Newberry, and in Contra Costa Co. by Mr. J. H. Thomson. The latter gentleman's notes show the animal to be quite distinct from that of *H. concava* Say, however similar the shells may be, with the exception of the striæ on the Californian species. He writes, "Animal uniformly white or flesh-colored, with an orange line on top of back. Solitary — or only found in pairs."

### HELIX NEWBERRYANA.

PLATE LXXVI. FIGURE 7.

Testa latè umbilicata; orbiculato-depressa; solida; striis tenuibus incrementi et lineis subtilissimis, spiralibus, leviter granulato-decussata; nigra, aut rufo-brunnea, sub epiderme alba; sutura valdè impressa; spira depressa; anfr. 6, regulariter accrescentes, superi plani, ultimus convexus, subtus rotundatus, ad aperturam descendens; umbilicus latus, perspectivus, anfr. omnes ad apicem monstrans; apertura obliqua, transverso-lunaris; in exemplis junioribus, paries aperturalis, sculpturâ anfr. præcedentis callo levi obliterated, eleganter notata est lineis elevatis, numerosis, confertis, spiralibus; in exemplis maturis, hæc sculptura occulta est callo incrassato, sed intus in anfr. omnibus remanet; perist. simplex, acutum, intus callosum, marginibus sub-convergentibus, callo albo conjunctis.

#### SYNONYMS AND REFERENCES.

*Helix Newberryana* W. G. BINNEY, Proc. Acad. Nat. Sc. of Phila. x. p. 115, Notes, p. 16. May. 1858.

#### DESCRIPTION.

*Animal* not observed.

*Shell* broadly umbilicated; orbicularly depressed; solid; lightly decussated by incremental striæ, and numerous fine spiral lines: color black or reddish-brown, under the epidermis white and shining; suture deeply impressed; spire depressed; whorls 6, regularly increasing, the upper



ones flattened, the last convex, rounded below, and slightly deflected at the aperture; umbilicus broad, showing all the volutions clearly; aperture oblique, transversely-lunar; in young specimens the decussated sculpturing of the shell on the parietal wall of the aperture is covered with a light callus as the animal grows, and elegantly marked with numerous fine, crowded, spiral lines; in mature specimens this beautiful marking is entirely obliterated by the deposition of callus, but on breaking the shell, the lines will be found to exist within; peristome simple, acute, thickened within, ends slightly approximated, joined with a white callus.

Greater diameter, 37; lesser, 20; height, 13 millimetres.

*Geographical Distribution.* Found in considerable quantity by Dr. J. S. Newberry, of the Colorado Exploring Expedition, (Lieut. Ives,) within a few miles of San Diego.

*Remarks.* This species bears no close resemblance to any known American *Helix*. It belongs to the same group as *H. Vancouverensis* Lea, but differs in size, color, number of whorls, umbilicus, want of peculiar depression of the lip, by its beautifully decussated surface, and peculiar parietal wall of the aperture. In form alone, dead specimens may be compared with *H. algera* Lin., of Europe, but the spire is flatter and umbilicus larger.

I am unacquainted with any other species of *Helix*, distinguished by a like peculiarity of the parietal wall of the aperture.

Named in honor of Dr. J. S. Newberry, the Geologist of the Colorado Ex. Ex.

Very abundant at the locality given above. But few fresh specimens were brought, however, owing to the fact of there having been a drought for several years before the visit of the Expedition.

**HELIX CULTELLATA** THOMSON.

PLATE LXXVI. FIGURE 6.

Testa orbiculato-depressa, nitens, carinata, corneo-rufescens, ad peripheriam et ad suturas albo-zonata; anfr.  $6\frac{1}{2}$  convexiusculi, striis minutis incrementalibus at lineis microscopicis spiralibus decussati; sutura impressa, apertura oblique lunaris; perist. simplex, acutum, ad columellam vix reflexiusculum; subtus lævigata, albida, infra carinam latè rufo-corneo-zonata; umbilicus perspectivus, anfr. omnes ad apicem monstrans.

## SYNONYMS AND REFERENCES.

*Helix cultellata* THOMSON, in Proc. Phila. Acad. Nat. Sc. ix. p. 185, Oct. 1857; Notes, p. 5.

## DESCRIPTION.

*Animal* twice the length of the diameter of the shell; color reddish.

*Shell* orbicular, depressed, carinated, shining, reddish horn color, with a broad revolving band of white at the periphery and sutures; whorls  $6\frac{1}{2}$ , rather convex, decussated by minute lines of growth and microscopic revolving lines; below these lines are obsolete, the surface is shining, whitish, with a broad reddish horn-colored band below the carina; suture impressed; aperture oblique, lunate; peristome acute, not thickened and scarcely reflected at the umbilicus, which is broadly expanded, and shows all the volutions to the apex.

Greater diameter, 35; lesser, 19; height, 13 millimetres.

*Geographical Distribution.* Found plentifully in Contra Costa Co., California, by Mr. J. H. Thomson, of New Bedford, Mass.

*Remarks.* Mr. J. H. Thomson, of New Bedford, Mass., proposes this name for a shell found by him living in considerable quantities. The circumstances in which it was discovered are very unfavorable to the supposition of its having been brought from abroad. The chances of a Dalmatian shell having been introduced into California,

and already multiplying there, are very small indeed. At the same time the shell before me bears strong resemblance to the European group of this type. It seems to be between *H. albanica* Ziegler, and *acies* Partsch; the carina being less sharp than in the latter. Mr. Thomson suggests that it may have been imported from the Sandwich Islands on vegetables, but there is no species native to that region which bears any resemblance to this.

Since the publication of this species in the Proceedings of the Academy of Natural Sciences, my doubts of its being a native of California have been materially lessened by the discovery of the allied species, *Helix Newberryana*, from the same Zoölogical region. The resemblance of *H. cultellata* to the group of Eastern Europe is quite remarkable, yet our knowledge of the Mollusks of the Pacific Coast is still too imperfect to allow us to consider this as a unique example of resemblance between species of the two regions.

**HELIX STRIGOSA** GOULD.....vol. ii. p. 210, pl. xxvi.

*Helix strigosa* GOULD, U. S. Ex. Ex. p. 36, fig. 41.

PFEIFFER, l. c. iii. 112; Malac. Blatt. 1857, 32.

“Rocky Mountains in New Mexico.” (Pfeiffer).

#### SPURIOUS SPECIES.

*Helix Sagraiana* Orbigny, a Cuban species, is erroneously attributed to California (on the authority of Sowerby) by Pfeiffer (Mon. i. 325) and Carpenter (Report, p. 214).

#### EXTRA LIMITAL SPECIES.

The following species have not yet been found within the territory of the United States, though they are known to exist in the neighboring States of Mexico.

*Helix Acutedentata* W. G. Binney. Plate lxxvi. Figure 1, and  
*Helix Loisa* W. G. Binney. Plate lxxvi. Figure 2. (Notes

No. 2). These are perhaps but varieties of the same species.

They inhabit Sinaloa, on the banks of the Mazatlan River.

*Helix aspersa*, Muller, is said by Forbes (Proc. Zool. Soc. 1850, p. 53) to have been found at Santa Barbara. Its presence may have been accidental.

*Helix Mazatlanica* Pfeiffer, Mal. Blatt. iii. 43, is attributed to the locality from which its name is derived.

#### GENUS BULIMUS SCOPOLI.

##### BULIMUS CALIFORNICUS REEVE.

PLATE LXXIX. FIGURE 15.

Bul. testâ subacuminato-ovatâ, tenuiculâ, vix umbilicatâ, anfr. 6, lævis, columellâ reflexâ, labro simplici; lacteâ, zonulis interruptis transversis cæruleo nigricantibus cingulatâ.

*Hab.* California.

There is little novelty in the character or general aspect of this species, but it is certainly distinct. (Reeve).

#### SYNONYMS AND REFERENCES.

*Bulimus Californicus* REEVE, Con. Icon. No. 378, (Dec. 1848).

PFEIFFER, Mon. Hel. Viv. iii. 422.

*Remarks.* I have seen no authentic specimen of this species. Above is Reeve's description, and his figure is given on the plate referred to. Judging from them, I cannot agree with the opinion expressed by Gould (vol. ii. p. 275) that it is identical with *B. serperastrus*. The figure is one half larger than the natural size of the shell.

##### BULIMUS EXCELSUS GOULD.

PLATE LXXIX. FIGURE 12.

T. elongato-ovata, acuminata, solidiuscula, lævis, fulvida, albido strigata; spira elevata, peracuta, anfr. 7, ultimo trientes duos long. vix æquante: apertura trientem long. adequans, sub-ovata; labro albo anticè revoluta, subcontinuo, ad columellam expanso, fissuram latam obtegente.

*Bulimus excelsus* GOULD, Journ. Boston Soc. Nat. Hist. vol. vi. part 3, p. 376, pl. xiv. fig. 3, (Oct. 1853).

*Bulimus elatus* GOULD, l. c. in tab.

Shell ovate-fusiform, rather solid, smooth, pale coffee-colored,



with unequal longitudinal strigæ of white shading into each other, white at suture; spire acute, elongated; whorls seven, moderately convex, the last not quite two thirds the length of the shell; aperture less than half the length of the shell, obliquely subovate, lip soon becoming revolute, broadly so in front, rising, a little narrowed by a somewhat abrupt curve upon the columella, and expanding again as it rises, until the two extremities of the lip nearly meet; the columellar portion stands off from the body whorl, displaying a large umbilical fissure; lip white, with a brown submargin at the point of reflection.

Length,  $1\frac{3}{4}$  inch; breadth,  $\frac{3}{4}$  inch.

Inhabits California. *Maj. Rich.*

This shell has very much the appearance of *B. Lobbi* Reeve, from Peru; but the aperture is larger and differently proportioned; the colors are less bright, the stripes broader and more blended. *B. pallidior* Sowerby, has the aperture more like it, but is colorless, and has the spire less elongated. In form it is also much like *B. xanthostoma* D'Orb. It has the form of *B. membranaceus*, but is much larger and thicker.

This is Gould's description. His figure is given in the plate referred to. I have not seen the shell.

#### EXTRA LINITAL.<sup>1</sup>

*Bulimus chordatus* Pfeiffer,  
*Humboldti* Reeve,  
*Mexicanus* Lamarck,  
*Zebra* Müller,  
*Ziegleri* Pfeiffer,

have been detected in Cinaloa.

*Bulimus vegetus* Gould, was found at San Juan, Gulf of California, (Bost. Journ. vi. 375).

*Bulimus vesicalis* Gould, (l. c. Oct. 1853) "inhabits lower California." This name being preoccupied by a species described by Pfeiffer, (March, 1853,) Gould suggests *sufflatus* in its stead.

<sup>1</sup> *Bulimus Laurentii* Sowerby, var.  $\beta$ , is mentioned by Pfeiffer (Mon. Hel. Viv. ii. 218) as inhabiting "Sitka littoris Americæ occidentalis." Whether he refers to the Sitka of the northwest coast, or some South American locality, I do not know.

## GENUS ACHATINA LAMARCK.

## ACHATINA CALIFORNICA PFEIFFER.

PLATE LXXIX. FIGURE 19.

Testa subulata, tenuis, oblique confertissime rugoso-striata, cereo-albida: anfr. 12-13, summi convexi, 3-4 ultimi planati, ultimus 1-6 longitudinis paulo superans, basi acute carinatus, infra carinam subexcavatus; columella arcuata, basin attingens, incrassata, subtruncata; apertura subtetragona; perist. simplex, acutum. Long. 23, diam.  $3\frac{1}{2}$  mill. Ap. 4 mill. long.  $2\frac{1}{4}$  lata. (Pfr.)

*Achatina Californica* PFEIFFER, Symb. ad. Hist. Hel. 3, p. 89; Mon. Hel. Viv. ii. 267, iii. 501.

REEVE, Con. Icon. 115, (Mar. 1850).

*Remarks.* I have not seen this species, which is said to inhabit "Monterey, California." The figure I have given is a copy of Reeve's reduced to the natural size of the shell.

## EXTRA LIMITAL.

## GENUS GLANDINA SCHUMACHER.

*Glandina Albersi*, Pfeiffer, and

*G. turris*, Pfeiffer, are included by Carpenter in the Catalogue of the Riegen Collection, (p. 175).

## FAMILY AURICULACEA.

## SUB-FAMILY MELAMPEA.

## GENUS MELAMPUS MONTFORT.

## MELAMPUS OLIVACEUS CARPENTER.

PLATE LXXIX. FIGURE 8.

*M. t.* parvâ, sublævi, conoideâ, spirâ depressâ, infra suturam indistinctam obscure angulatâ; albidâ, fusco-purpureo irregulariter tessellata, epiderme adhærente, obivaceâ indutâ; anfr. 7 vix mostrantibus, planatis; aperturâ longâ, angustâ, ad marginem fusco-purpureâ, intus albâ; labro ad marginem acuto, intus dentato, dentibus in liras acutas, in adultâ sæpe obsoletas, decurrentibus; labio tenui, plicâ unâ parietali, transversâ, inter denticulas duas sitâ, in juniore denticulis numerosis intus conditis; columellâ plicâ unâ obliquâ, ad basin excurrente; parietibus internis in adultâ absorptis. (Carpenter, l. c.)

## SYNONYMS AND REFERENCES.

*Melampus olivaceus* CARPENTER, in Riegen Cat. of British Museum, p. 178. anno. 1857.

## DESCRIPTION.

*Animal* not yet observed.

*Shell* small, rather smooth, conical; spire depressed, obtusely angulated below the suture, which does not distinctly separate the whorls; color dirty white, with irregular patches or revolving lines of dark red or purplish; epidermis olive-colored; on young or very fresh specimens there are sometimes microscopic revolving lines near the base of the shell, and on the spire, which cross the delicate lines of growth so as to present under the microscope a granulated surface; whorls 7 to 9, the upper ones distinguished only by means of the lens, and flattened; aperture long, equalling  $\frac{11}{13}$  of the shell, edge variegated in color by the termination of the reddish bands on the white ground of the shell, within white; the outer lip is furnished with numerous sharp, white laminæ, in the specimens before me varying from 1 to 9; the parietal wall of the aperture is covered with an almost imperceptible, shining, callus; there is one constant, prominent, elevated white tooth-like lamina revolving within the shell, which is usually placed within two smaller shorter ones; on the columella there is also a stouter lamina entering into the aperture, and passing outwards and curving downwards so as to join the termination of the labium.

Long. 13; diam. 18 mill.

*Geographical Distribution.* Mazatlan, (Riegen Cat. not uncommon,) San Diego, (Mr. W. P. Blake, in Smithsonian Collection).

*Remarks.* This is the first species of the family Auriculacea found on the Pacific coast of North America. There were numerous specimens found by M. Riegen, which Mr. Carpenter describes as distinguished generally

by the olive-green epidermis, variegated with purplish-brown patches. I find the number of laminæ in the aperture very variable, but the two prominent ones on the labium are constant in all the individuals I have had the opportunity of examining.

Mr. Carpenter (l. c.) says that M. Mörk has labelled this in Mr. Cuming's collection "*Melampus bidentatus* Say," and justly adds that it is much more nearly allied to *Melampus coffeus* Lin. It seems to me, however, to be a peculiarly well marked species.

The figure is taken from a specimen in the cabinet of the Boston Society of Natural History, labelled by Mr. Carpenter.

I am indebted to the kindness of Prof. S. F. Baird for specimens of this species.

## FAMILY ACICULACEA.

### GENUS TRUNCATELLA RISSO.

#### TRUNCATELLA CALIFORNICA PFEIFFER.

PLATE LXXIX. FIGURES 20, 22.

T. non-rimata, turrito-cylindræa, truncata, tenuiscula, leviter striata, parum nitens, pallide rubello-cornea; spira sursum vix attenuata; sutura simpliciter marginata; anfr. superst. 4 convexi, sensim accrescentes, ultimus basi non compressus; apertura verticalis, ovalis, superne vix angulata; perist. simplex, continuum, margine dextro expanso, superne sub-repando, columellari adnato. [Pf.]

#### SYNONYMS AND REFERENCES.

*Truncatella Californica* PFEIFFER, Proc. Zool. Soc. London, May, 1857, p. 111; Mon. Pneum, Viv. ii. p. 7.

#### DESCRIPTION.

*Animal* not observed.

*Shell* imperforate, cylindrical, truncated at tip, thin and translucent with light striæ, shining, amber-colored; spire in the perfect state of the shell composed of about



10 whorls, of which 4 only are not deciduous; these are convex, increasing in size rather rapidly; aperture oval, vertical, rounded above; peristome simple and continuous, slightly expanded, its pillar margin scarcely attached to the shell.

Length  $4\frac{2}{3}$ , diam.  $1\frac{2}{3}$  mill.

*Geographical Distribution.* San Diego, California.

*Remarks.* This is the only *Truncatella* yet found on the western coast, excepting, perhaps, the doubtful species from Mazatlan mentioned in the Riegen Catalogue, p. 364.

It is readily distinguished by its amber or deep honey color, and its shining surface nearly unbroken by ribs. The bars are numerous, and are distinguished rather by making the shell more opaque than by their prominence.

I am indebted to Mr. Cuming for the figure I have given of a specimen in his collection, and to Dr. Gould for specimens of the shell.

This is the *Truncatella gracilentia* mentioned in the Errata of Vol. X. Phila. Proc. That name was proposed by Gould before meeting with Pfeiffer's description.

## 2. THE SPECIES EAST OF THE ROCKY MOUNTAINS.

### FAMILY LIMACEA.

#### GENUS VAGINULUS FERUSSAC.

**VAGINULUS FLORIDIANUS** BINNEY..... vol. ii. p. 17, pl. lxxvii.

#### SPURIOUS SPECIES.

The following species are catalogued by Grateloup among the American *Vaginuli*, (Dist. Geog. des Limaciens, p. 22). They were all described by Rafinesque, and by him placed in his genus *Philomycus*. From the general inaccuracy of that author, as well

as the deficiency of the descriptions, I think they should be excluded from this or any genus.

*Vaginulus flexuolaris*,  
" *fuscus*,

*Vaginulus oxyurus*,  
" *quadrilus*.

#### GENUS *TEBENNOPHORUS* BINNEY.

The first accurate description of this genus was published by Binney in 1841, (Proc. Boston Soc. p. 51). I have therefore given preference to the name he proposed over that of Rafinesque usually adopted. (Vol. II. p. 19).

Since the publication of the "*Terrestrial Mollusks*," the name *Tebennophorus* has been retained in this country by Stimpson (Shells of N. E.) and by Grateloup, abroad. On the other hand, *Philomycus* has been adopted in Adams's Genera of Recent Mollusca, where the characteristics of the mantle are correctly given; and in the British Museum Catalogue of Pulmonata.

***TEBENNOPHORUS CAROLINENSIS*** Bosc. vol. ii. p. 20, pl. lxiii. fig. 1, 2.

*Limax Carolinensis* MRS. GRAY, Fig. Moll. An.

*Limax marmoratus* DEKAY, *absq. desc.*

LINSLEY, Shell of Conn. 9.

*Philomycus Carolinensis* GRAY and PFIEFFER, Brit. Mus. Cat. Pulm.

H. and A. ADAMS, Genera, ii. p. 220. June, 1855. *absq. desc.*

*Tebennophorus Carolinensis* DEKAY, N. Y. Moll. p. 24.

STIMPSON, Shells of N. E. p. 56, *absq. desc.*

In 1842 (Boston J. N. H. iv. 2) Dr. Binney referred the *Limax Carolinensis* of Bosc to this genus. His description was the first correct one ever published. I have therefore retained the name he proposed for it.

Rafinesque's Genus *Philomycus* bears an earlier date than *Tebennophorus*. His description appears to me insufficient to warrant this species being referred to his genus, as it has been in the works referred to in the synonymy.

From letters of Dr. Newcomb to Dr. Binney (1845) it appears probable that *Limax marmoratus* of DeKay's ear-

lier report (1839, p. 31) and Linsley's Shells of Connecticut (p. 9) are to be referred to this species. Its characters are also given by Adams, in Silliman's Journal, vol. 40, p. 275, (1841). I have also in my possession unpublished notes of Say in which he accurately describes this species, and points out the defects of Ferussac's and Rafinesque's descriptions of *Philomycus* and *Eumelus*.

For anatomy of this species, vid. Wyman, Boston Soc. Proc. i. p. 154.

It is found sparingly in Burlington Co., New Jersey.

**TEBENNOPHORUS DORSALIS** BINNEY. . . . . vol. ii. p. 24, pl. lxiii. fig. 3.

*Philomycus dorsalis* BINNEY, Proc. Boston Soc. 1841, p. 52.

GRAY and PFEIFFER, Brit. Mus. Cat. of Pulmonata.

ADAMS, Gen. Rec. Moll. ii. p. 220, *absq. desc.*

*Limax dorsalis* DEKAY, N. Y. Moll. p. 22.

#### SPURIOUS SPECIES.

*Tebennophorus bilineatus* Cart., of Grateloup (Dist. Geog. p. 30) is unknown to me.

#### GENUS ARION FERUSSAC.

**ARION HORTENSIS** FERUSSAC. . . . . vol. ii. p. 27, pl. lxiv. fig. 1, lxv. fig. 2.

*Arion hortensis* DEKAY, N. Y. Moll. p. 23.

#### SPURIOUS SPECIES.

*Arion empiricorum* Ferussac is quoted as an inhabitant of the Western United States by Grateloup, (Dist. Geog. des Limaciens, p. 8). It has not been noticed by any American writer.

*Arion foliolatus* Gould is erroneously ascribed to Boston by the same author, (p. 8). It is an inhabitant of the Pacific Coast.

#### GENUS LIMAX FERUSSAC.

**LIMAX VARIEGATUS** DRAPANAUD. . . . . vol. ii. p. 34, pl. lxv. fig. 1.

*Limax flavus* DEKAY, N. Y. Moll. p. 21, pl. i. fig. 5.

GRAY and PFEIFFER, Brit. Mus. Cat.

**LIMAX AGRESTIS** MÜLLER. . . . . vol. ii. p. 36, pl. lxiv. f. 2.

*Limax agrestis* DEKAY, N. Y. Moll. p. 20, pl. i. fig. 4.

Mörch (Moll. Grœnl. p. 75) quotes this species as an inhabitant of Greenland.

**LIMAX CAMPESTRIS** BINNEY.....vol. ii. p. 41, pl. lxiv. fig. 3.

*Limax campestris* BINNEY, Proc. Boston Soc. 1841, p. 52.

DEKAY, N. Y. Moll. p. 23.

#### SPURIOUS SPECIES.

*Limax Columbianus* Gould, is quoted erroneously by Grateloup (Dist. Geog. des Limaciens, p. 14) as inhabiting the Northern and Western States. It is found only on the Pacific Coast.

*Limax fuliginosus* Gould, and

*Limax olivaceus* Gould, are erroneously quoted by the same author (p. 30) as American.

*Limax lineatus* DeKay, is mentioned by name only, (vol. ii. p. 33).

*Limax gracilis* Rafinesque, of Grateloup and Gray and Pfeiffer, is *Deroceras gracilis* of the following list.

Of the following species of Rafinesque, Nos. 1, 2, and 3 are quoted in Grateloup's Catalogue, and No. 4–10 are described in the British Museum Catalogue of Pulmonata. The original description of these species is given in vol. i. p. 51, *et seq.*

- |                 |                   |
|-----------------|-------------------|
| 1. Eumelus      | 6. Philomycus     |
| 2. " lividus,   | 7. " flexuolaris, |
| 3. " nebulosus, | 8. " fuscus,      |
| 4. Deroceras    | 9. " oxyurus,     |
| 5. " gracilis,  | 10. " quadrilus.  |

Gray and Pfeiffer also ascribe to Rafinesque the genera *Testacina*, *Urcinella*, and *Zilotea*. I have never met with any description of them, and therefore exclude them with the others as unworthy of a place in the Catalogue of American *Pulmonata*.

### FAMILY HELICEA.

GENUS VITRINA DRAPANAUD.

**VITRINA ANGELICÆ** BECK.

PLATE LXXIX. FIGURE 9.

Testa convexiusculo-depressa, lævigata, nitida, pellucida, virenti-lutea; spira parvula, sub-prominula; sutura subtiliter crenulata; anfr.  $3\frac{1}{2}$  rapidé accrescentes, ultimus subtus latus; apertura obliqua, lunato-ovalis; perist.



simplex, subinflexum, margine columellari non recedente, leviter arcuato. Diam. maj. 6; min.  $4\frac{2}{3}$ ; alt.  $3\frac{1}{2}$  mill. [Pfeiffer].

## SYNONYMS AND REFERENCES.

*Vitrina Angelicæ*, BECK, Index, p. 1 (*absq. desc.*)

MÖLLER, Index Moll. Grœnl. p. 4, (teste Pfr.)

PFEIFFER, Mon. Hel. Viv. ii. p. 510.

MÖRCH nat. Bidr. af Gron. p. 75 (*absq. desc.*)

*Helix pellucida* FABRICIUS, Fauna Grœnl. p. 389, excl. Syn. Müller.

*Helix domestica* STRÖM, Der Tronh. Vidensk. &c. vol. iii. p. 435, tab. vi. fig. 15, (teste Fabricius).

**Geographical Distribution.** Found in Greenland. Archangel (Fabricius).

**Remarks.** "Closely resembling *V. pellucida*, being scarcely distinguished by the more rapidly enlarging whorls, and the form of the aperture." (Pfeiffer, l. c.) I have not seen this species. The figure I have given was drawn from a specimen in Mr. Cuming's collection.

Fabricius referred this species to *V. pellucida* Müller. His description is given below. I have not been able to obtain access to Ström's description.

HELIX PELLUCIDA (Fabricius, l. c.) *Helix testa imperforata, depressiuscula nitida, subvirescente, anfr. tribus.* Descriptionem hujus exactissimam ap. Müll. de Verm. l. c. habemus. Vertex in meis omnibus albus, reliquum testæ albido-virescens. Anfractus maximus verticaliter plures strias subtiles subeminentes habet, ad suturam notabiliores.

VITRINA LIMPIDA GOULD. .... vol. ii. p. 58, pl. lxvii. a, fig. 1.

*Vitrina pellucida* DEKAY, N. Y. Moll. p. 25, pl. iii. fig. 4, 5 a. b.

STIMPSON Shells of N. E. p. 55, (*absq. descr.*) Say (Binney) p. 31.

*Vitrina Americana* PFEIFFER, Dec. 1852, Proc. Zool. Soc. p. 156.

CHEMNITZ, ed. 2, p. 9, pl. i. fig. 22-25, (1854).

*Vitrina limpida* GOULD, in Agassiz, Lake Superior, p. 243, 1850. Terr. Moll. l. c. PFEIFFER, Malac. Blatt. ii. p. 10, (1856).

In 1850 this species was declared to be distinct from the European *V. pellucida* by Gould. In 1852 a description of it was published by Pfeiffer under the name of *V. Americana*. That author has since withdrawn his name in favor of Gould's.

Say changed his opinion of the identity of this species and *V. pellucida*, subsequently to the publication of Long's Expedition. Among his notes, kindly furnished me by Mrs. Say, is a description of it under the name of *Helicolimax canaliculata*. The description was never published.

Stimpson (l. c.) observes, "This being a boreal species, occurring in Greenland, it is probable that it is identical with the European one to which it was referred by Mr. Say."

#### GENUS SUCCINEA DRAPANAUD.

**SUCCINEA CAMPESTRIS** SAY.....vol. ii. p. 67, pl. lxvii. b, fig. 1.

*Succinea campestris* SAY, (Binney's ed.) p. 12.

PFEIFFER, Symb. ii. p. 56, (excl. Syn. Gould); Mon. Hel.

Viv. ii. p. 524, (excl. do.); iii. p. 15, (excl.

Syn. DeKay).

CHEMNITZ, ed. 2, p. 48, pl. v. f. 5, 6, (1854).

DESHAYES in Fer. ii. p. 139, nec DeKay, p. 54; Adams,

Linsley, Anthony, Prescott, (abs. desc.)

In Chemnitz, Pfeiffer, and Deshayes, *S. campestris* Gould is erroneously quoted as a synonym of this species.

Bishop Elliott discovered in the old cemetery at Savannah a variety, distinguished by a beautiful golden apex and uniform amber color.

Authentic specimens of this species are still preserved in the collection of the Philadelphia Academy of Natural Sciences.

**SUCCINEA INFLATA** LEA.....vol. ii. p. 66, pl. lxxx. fig. 11.

Having examined the original specimen of this shell in Mr. Lea's cabinet, I am inclined to doubt its specific weight. I have, however, had an outline of his specimen figured, and propose to leave to the future the question of its identity with *S. campestris* Say.

*Succinea inflata* LEA, l. c. 1841; Tr. Am. Phil. Soc. ix. p. 5, (1844).

PFEIFFER, Mon. Hel. Viv. ii. p. 526; iii. p. 16.

CHEMNITZ, ed. 2, p. 49, pl. v. fig. 9-11, (1854).

*Succinea campestris* var. BINNEY, vol. ii. p. 67.

Pfeiffer observes that the specimens which he describes were received from Griffith, and agree with Ferussac's figure of *S. campestris*.

The same author mentions a variety "Unicolor, corneolutea," from the vicinity of New Orleans.

**SUCCINEA OBLIQUA** SAY.....vol. ii. p. 69, pl. lxvii. b, fig. 3.

*Succinea obliqua* SAY (Binney's ed.) p. 32, pl. lxxiv. f. 7.

CHEMNITZ, ed. 2, p. 47, pl. v. fig. 1, 2, (1854).

PFEIFFER, Mon. Hel. Viv. iii. p. 15.

*Succinea ovalis* SAY (Binney's ed.) p. 8.

ADAMS, Shells of Vermont, p. 6, (1842).

DESHAYES, in Encycl. Meth. ii. p. 20; Fer. Hist. l. c. ii. p. 139, (excl. syn. Gould).

PFEIFFER, Mon. Hel. Viv. ii. p. 524; iii. p. 15, (excl. syn. Gould).

CHEMNITZ, ed. 2, p. 48, pl. v. fig. 3, 4.

*Succinea lineata* DEKAY, N. Y. Moll. p. 53, pl. iv. f. 51.

*Succinea campestris* of all American authors except Say.

Pfeiffer in 1841 (Symb. i. p. 7) says of *Succinea obliqua*, "An potius Linnæus." In 1853 he describes it as a *Succinea*.

It has been found at Ottawa City, Canada, (J. H. Redfield), and in the basin of the Red River of the North, (Robert Kennicott).

**SUCCINEA TOTTENIANA** LEA.....vol. ii. p. 65, 72, pl. lxvii. b, fig. 2.

*Succinea Totteniana* LEA, Proc. Phil. Soc. ii. p. 32, (1841); Tr. Am. Phil. Soc. ix. p. 4, (1844).

PFEIFFER, Mon. Hel. Viv. ii. p. 526; iii. p. 15.

GOULD, in Terr. Moll. l. c.

*Succinea obliqua* BINNEY, var. l. c.

I agree entirely with Lea and Gould in separating this shell from *S. obliqua*. Its characteristics are constant and well marked in specimens, in my cabinet, obtained from Newport, R. I. (Lea); Maine, (Binney); Greenwich, N. Y. (Ingalls); and Marblehead, Mass. (J. P. Haskell).

**SUCCINEA AVARA** SAY.....vol. ii. p. 74, pl. lxvii. c, fig. 4.

*Succinea avara* SAY, (Binney's ed.) p. 32, pl. 74, f. 6.

PFEIFFER, Symb. ii. p. 56; Mon. Hel. Viv. ii. p. 525, iii. p. 15.

*Succinea avara* DE KAY, N. Y. Moll. p. 54, pl. iv. fig. 55.

CHEMNITZ, ed. 2, p. 51, pl. v. fig. 18-20, (1854).

*Succinea Wardiana* PFEIFFER, Mon. Hel. Viv. ii. p. 525; iii. p. 15.

LEA, Tr. Am. Phil. Soc. ix. p. 3, (1844).

Pfeiffer (l. c.) gives Lea's description of *S. Wardiana*, marking the species as one he had not seen.

Specimens which are apparently referable to *S. avara* have been found at Alexandria, La. (Coll. Lea), and at St. Simon's Isle, Ga. (Postell).

I have found this species under logs, at great distances from any water. In this respect its habits differ from those of the other *Succineæ* of America.

In my Notes, No. 4, I have catalogued *Succinea vermeta* separately. I am not at all convinced of its identity with this species. I have never seen any specimen answering Say's description of the suture. It seems best, however, to leave *S. vermeta* in the synonymy of *S. avara*, where it has been placed by Binney, Gould, Adams, De Kay, and Pfeiffer. The original description is given below.

It is very certain that the large variety of *S. avara* is not *S. vermeta*, though usually known by that name. It sometimes reaches the length of 13 millimetres. I have it from Ohio, Utica, N. Y. (Jewett), and Mohawk, N. Y. (Lewis).

Say's original specimens of *S. avara* are preserved in the Philadelphia Academy.

SUCCINEA VERMETA (Binney's ed. p. 38). Shell suboval, yellowish, very thin and fragile, somewhat diaphanous, with nearly three very oblique volutions; whorls very much rounded, wrinkled; suture very profoundly impressed; spire rather prominent and acute; aperture ovate, the superior termination rounded.

Inhabits margins of ponds near New Harmony.

This species is remarkable for the very deep indentation of its suture, giving to the whorls of the spire the appearance of being almost separated from resting on each other; and by this character it may be readily distinguished from the other species of this country. It was found by Dr. Troost. (Say).



**SUCCINEA AUREA** LEA..... vol. ii. p. 76, pl. lxvii. c. fig. 3.

*Succinea aurea* LEA, Tr. Am. Phil. Soc. ix. p. 4, (1844).

PFEIFFER, Mon. Hel. Viv. ii. 525; iii. 15.

*Succinea ovalis* var. ANTHONY, Shells of Ohio. 1843.

It has been found on Goat Island, Niagara Falls, (T. Bland.)

**SUCCINEA OVALIS** GOULD, non SAY..... vol. ii. p. 78, pl. lxvii. a. fig. 3.

The only other reference to this species is in Gould's Invertebrata and perhaps in Adams's Shells of Vermont. Other authors have confounded it with Say's species.

I have specimens from Wisconsin, (Lapham); South Illinois (Kennicott); Michigan (Winchel); and Burlington, N. J.

**SUCCINEA RETUSA** LEA..... vol. ii. pp. 65, 66.

PLATE LXXIX. FIGURE 7.

*Succinea retusa* LEA, Trans. Am. Phil. Soc. vol. v. p. 117, pl. xix. fig. 86, (1837).

DEKAY, N. Y. Moll. p. 55.

PFEIFFER, Mon. Hel. Viv. ii. p. 525.

*Succinea campestris* ANTHONY, Ohio Cat. absq. descr.

If this species were identical with *S. ovalis* Gould, as suggested by Binney, it would take precedence by the rule of priority of publication. After examining the specimen from which Lea's description was drawn, I have decided to consider it a distinct species. The figure is a fac-simile of the outline of Lea's.

Pfeiffer had not seen this species, and DeKay mentions it among the extralimital species.

Lea remarks, (l. c.) "It differs so much from any of the described species, in the dilatation and retraction of the inferior part of the aperture, that I have not hesitated to consider it new."

**SUCCINEA GROENLANDICA** BECK.

PLATE LXXX. FIGURE 4.

*T. oblonga, solidula, striatula, vix nitidula, pallide cornea, albido-strigata; spira scalaris, papillata; anfr. 3, penultimus perconvexus, ultimus  $\frac{2}{3}$  longitudinis subæquans; columella substrictè recedens; apertura ovalis; perist. simplex, margine dextro arcuato. Long. 8; lat.  $5\frac{1}{2}$ ; alt.  $3\frac{1}{2}$  mill. Ap.  $5\frac{1}{2}$  mill. longa,  $3\frac{1}{2}$  lata. (Pfeiffer).*

## SYNONYMS AND REFERENCES.

*Succinea Groenlandica* BECK, Ind. abs. desc.

PFEIFFER, Mon. Hel. Viv. ii. 529; iii. 20.

MÖLLER, Ind. Moll. Grœnl. p. 4, (teste Pfr.)

## DESCRIPTION.

*Animal* not observed.

*Shell* elongated, rather heavy, lightly wrinkled, of a light horn color, mixed with white; spire scalariform, bulbous; whorls 3, the penultimate quite convex, the last equalling about  $\frac{2}{3}$  the length of the shell; columella receding and narrowed, covered with a white callus; aperture oval; peristome simple, the right margin curved.

Greatest length 8, breadth  $5\frac{1}{2}$ , millimetres. Length of the aperture  $5\frac{1}{2}$ , breadth  $3\frac{1}{2}$ .

*Geographical Distribution.* Greenland (Möller, Mörch, &c.)

*Remarks.* This species is easily distinguished by its bulbous, turretted spire, and by its light horn color, broken by longitudinal white vittæ. When the epidermis is removed, the shell is of a dead white. The specimen figured is in Mr. Bland's collection.

**SUCCINEA LINEATA.**

PLATE LXXX. FIGURE 5.

*Testa oblongo-ovata, solidior, albida aut cinerea; spira elevata, acuta; anfractus 3 convexi, lineis parallelis inter rugas incrementales volventibus ornati; sutura impressa; apertura orbiculata-ovata, oviformis, partem testæ dimidiam æquans; columella plicata, callo albo induta.*



## SYNONYMS AND REFERENCES.

*Succinea lineata* W. G. BINNEY, Proc. Acad. N. S. of Phila. vol. ix. p. 19; Notes, p. 1, (February 1857). Proc. Boston Soc. N. H. vol. vi. p. 155, (April, 1857).

## DESCRIPTION.

*Animal* not observed.

*Shell* oblong-ovate, with three very convex whorls; spire elevated, acute; surface marked with irregular wrinkles of growth, between which are coarse parallel revolving lines, somewhat removed from each other. Aperture large, about as long as one half of the whole length of the shell, oval; columella folded; a deposition of callus on the parietal wall of the aperture.

Greatest diameter, 6; alt. 12 millimetres.

*Geographical Distribution.* Collected in considerable quantity by Dr. F. V. Hayden, (Yellowstone, Expl. Ex.) on high hills near Fort Union, Nebraska Territory.

*Remarks.* The specimens collected being dead and eroded, it is impossible to say what is the color of the shell when fresh. It is probably ashy white, resembling the true *S. campestris* of the Southern States. The revolving lines which distinguish it are most apparent on the middle of the body whorl. These are quite coarse, and placed at irregular intervals;—on some specimens scarcely discernible. The aperture is unlike that of any other of our species; being correctly egg-shaped,—it is nearest in form to that of *S. campestris*, but is less expanded. The parietal wall of the aperture is unusually horizontal.

In general aspect it resembles somewhat *S. vermeta*, but is distinguished from that shell by its more oval shape, and the greater convexity of the whorls. It is the heaviest American species.

This species must not be confounded with *S. lineata* DeKay.

## SUCCINEA HAYDENI.

PLATE LXXIX. FIGURE 1.

Testa elongato-ovalis, tenuis, pellucida, succinea; spira parva, acuta; anfr. 3 convexi, ultimus rugis levibus incrementalibus et sulcis crassis spiralibus, interruptis, inequaliter notatus; sutura mediocris; columella callo levi induta, apicem interiorem a basi testæ monstrans; apertura obliqua, ovalis, 5-7 long. testæ æquans, ad basin expansior.

## SYNONYMS AND REFERENCES.

*Succinea Haydeni* W. G. BINNEY, Proc. Acad. Nat. Sc. of Phila. x. p. 114. May, 1858. Notes, p. 15.

## DESCRIPTION.

*Animal* of an uniform amber color, judging from the specimens preserved in spirits in the collection of the Smithsonian Institute.

*Shell* elongate-oval, thin, shining, amber-colored; spire short, acute; whorls three, convex, the last marked with the wrinkles of growth, and irregular, heavy, spiral furrows; suture moderate; columella covered lightly with callus, and allowing all the interior whorls to be seen from below to the apex; aperture oblique, oval, 5-7ths the length of the shell, the lower portion of its margin considerably expanded.

Length 21; diameter 9 millimetres.

*Geographical Distribution.* Found in considerable numbers by Dr. F. V. Hayden, the Geologist of the Yellowstone Exploring Expedition, in Nebraska, between the rivers Loup Fork and L'eau qui court.

Var. *Minor*. Length 15 mill. Found by Mr. Robert Kennicott near the Red River of the North.

*Remarks.* This is the largest known American *Succinea*.

Mr. Say describes *S. ovalis* as showing the interior apex from the base of the shell; in other respects his description does not apply to this shell. Its aperture is nearer that of *S. ovalis* Gould non Say, but the peristome is

much more flexuose, and the upper third of the shell becomes gradually attenuated, so as to give a sharp pointed appearance, though the spire itself is short. The revolving lines are sometimes continuous over the whole body whorl, but generally interrupted, or confined to the interstices of the incremental striæ or wrinkles. It shares this peculiarity with *S. concordialis* Gould, and *S. lineata* nob.

Named in honor of Dr. F. V. Hayden, the discoverer of the species.

**SUCCINEA LUTEOLA** GOULD.....vol. ii. p. 75, pl. lxvii. c. fig. 1.

*Succinea luteola* PFEIFFER, Mon. Hel. Viv. iii. 16.

*Texasiana* PFEIFFER, l. c. vol. ii. p. 526; vol. iii. p. 17; in Roemer's Texas, p. 456.

CHEMNITZ, ed. 2, p. 42; pl. iv. f. 21-23, (1854).

Pfeiffer (Sept. 1857) writes "My *Succinea Texasiana* is a synonym of *luteola* Gould.

**SUCCINEA CONCORDIALIS** GOULD.....vol. ii. p. 82, pl. lxvii. a. fig. 2.

*Succinea concordialis* PFEIFFER, Mon. Hel. Viv. iii. p. 16.

*munita* BINNEY, vol. i.

#### **SUCCINEA EFFUSA** SHUTTLEWORTH.

##### PLATE LXXX. FIGURE 12.

T. depresso-ovata, tenuissima, striatula, parum nitens, diaphana, griseo-cornea; spira brevissima, acuta; anfr.  $2\frac{1}{2}$ , ultimus magnus, depressus, 5-6 longitudinis æquans, columella vix arcuata, subrecedens; apertura ampla, obliqua, ovalis; perist. simplex, regulariter arcuatum, basi non incumbens. (Pfr.)

##### SYNONYMS AND REFERENCES.

*Succinea effusa* SHUTTLEWORTH, mss.

PFEIFFER, Mon. Hel. Viv. iii. p. 17.

CHEMNITZ, ed. 2, p. 42, pl. iv. fig. 18-20, (1854).

##### DESCRIPTION.

*Animal* not observed.

*Shell* depressed-oval, very thin, transparent and shining, lightly striated, grayish horn-colored; spire remarkably

short, acute ; whorls  $2\frac{1}{2}$ , the last one very much the largest, depressed, equalling  $\frac{2}{3}$  the length of the shell ; columella scarcely rounded and hardly receding ; aperture very large, oblique and oval ; peristome simple, regularly rounding.

Length 12, diameter 7 millimetres. Length of the aperture 10, breadth 6 mill.

*Geographical Distribution.* East Florida (Pfeiffer) ; Spring Garden, Lake Florida (Bland's Coll.)

*Remarks.* It is readily distinguished from the other American species by the proportionally short spire, the very large body whorl, and expanded aperture.

#### SUCCINEA SALLEANA PFEIFFER.

##### PLATE LXXIX. FIGURE 18.

T. depresso-ovata, tenuissima, striatula, lineis spiralibus impressis irregulariter notata, pellucida, nitida, corneo-albida ; spira brevissima, subpapillata ; anfr.  $2\frac{1}{2}$ , penultimus convexus, ultimus  $\frac{3}{4}$  longitudinis superans ; columella subcallosa, stricte recedens ; apertura axi subparallela, angulato ovalis ; perist. submarginatum, margine dextro vix arcuato. Long. 19, diam. 10, alt. 7 mill. Ap. 16 mill. longa, infra medium 9 lata. (Pfeiffer).

Habitat prope New Orleans. (Sallé).

##### SYNONYMS AND REFERENCES.

*Succinea Salleana* PFEIFFER, Proc. Zool. Soc. Nov. 1849, p. 133 ; Mon. Hel. Viv. iii. 16.

CHEMNITZ, ed. 2, p. 49, pl. 5, fig. 7, 8.

*Remarks.* I have not seen this species. The above is Pfeiffer's description, and the figure given on pl. 79 is a fac-simile outline of that referred to.

##### SPURIOUS SPECIES.

*Succinea putris*, Lin., (DeKay, 1839, p. 31, Fer. Tabl. Syst. p. 9.)  
and

*Succinea amphibia*, Drap. (Forbes Br. Ass. 1837, p. 144, Ferussac ; Tabl. Syst. ; Binney, vol. ii. p. 159,) have been quoted from America. Having never seen a well authenticated specimen of either, I omit them.



GENUS *HELIX* LINNÆUS.

I have followed the artificial arrangement of species of this genus proposed on p. 92 of vol. ii.

**HELIX MAJOR** BINNEY.....vol. ii. p. 96, pl. 1.

*Helix major* DEKAY, N. Y. Moll. p. 45.

MRS. GRAY, Fig. of Mol. An. pl. 291, fig. 1, abs. desc. ex. Bost. Journ. non *major* Beck, p. 2.

*Helix albolabris* γ PFEIFFER, Symb. ad Hist. Hel. ii. 22; Mon. Hel. Viv. i. 290.

C. CHEMNITZ, ed. 2, i. 81, (1846).

*Helix albolabris* DESHAYES, in Fer. in tab. l. c.

REEVE, No. 656, (1852).

BLAND, Notes, p. 50, N. Y. Lyceum, vi. 359.

Well marked specimens of this species are rare in collections. It is, perhaps, owing to this fact that so few authors have followed Binney in separating it from *H. albolabris*.

For my own part, I am thoroughly convinced of its specific weight. Dr. Newcomb and Dr. Gould agree with me. On the other hand, Bland unites the two. It is subject to variation as are most of our species, and some individuals of *H. albolabris* may nearly approach some of its extreme forms. I am, however, confident of its being generally acknowledged as soon as it becomes better known.

The second figure of Ferussac referred to is a correct representation of the species. Deshayes makes no mention of it by name in the text of his continuation of that work, but appears to have confounded the two.

Mörch (Cat. Yoldi, p. 7) erroneously gives "*H. major*, Ohio."

It is catalogued distinct from *albolabris* by H. and A. Adams, ii. 206.

**HELIX ALBOLABRIS** SAY.....vol. ii. p. 99, pl. 11.

*Helix albolabris* SAY, (Binney's ed.) p. 21, pl. 69, fig. 1.

ADAMS, in Thompson's Vt. 1, 158, with wood-cut.



*Helix albolabris* CHENU, Bibl. Conch. 3, 23, pl. iii. fig. 3 a.

PFEIFFER, Symb. ad Hel. Hist. ii. p. 22, Excl.  $\gamma$  and  $\delta$ ; Mon. Hel. Viv. i. 290. Excl.  $\beta$  and  $\gamma$ ; iii. 269.

POTIEZ et MICHAUD, Gal. p. 69.

CHEMNITZ, i. 81, pl. xv. f. 7, 8, (1847). Excl. var. C. and D. pl. x. fig. 4, 5.

REEVE, Con. Icon. No. 624.

DESHAYES, in Fer. pl. xliii. fig. 1, 2, 3, 5; i. 137.

BILLINGS, Canadian Nat. and Geol. 1857, ii. 98, fig. 2, 3.

BLAND, N. Y. Lyc. vi. 358; Notes 49.

Pfeiffer's var.  $\gamma$  and  $\delta$  of the *Symbolæ* are respectively *major* and *exoleta*. In the Monograph his  $\beta$  is perhaps the former, and his  $\gamma$  certainly is. In Chemnitz ed. nov. he figures *exoleta* as var. D, and places *major* as C.

Deshayes in Ferussac's History erroneously gives Florida and Guadeloupe as the habitat. From his reference to Ferussac's plates he seems to confound *H. major* with *H. albolabris*.

Petiver mentions this species in Phil. Trans. 1698, p. 395.

As already mentioned, Bland unites *major* to this species.

I have this species from fourteen States. The series presents very remarkable variation in the height of the spire and in the form of the aperture. From Illinois I have a few of a large variety, furnished with a strong, tooth-like prominence on the reflected lip, near its columella extremity. There is a variety, quite common among the Pennsylvania Mountains, characterized by a strong parietal denticle. It might readily be confounded with *exoleta*, but wants the more ventricose body whorl of the latter. It occurs fossil in the Postpleiocene. From Natchez Bluff, I have specimens with a remarkably flattened spire.

*Helix rufa* DeKay (N. Y. Moll. p. 44, pl. iii. fig. 30 a b.) appears to be the young of this species. It certainly cannot be placed, even doubtfully, in the synonymy

of *lavigata*, as Pfeiffer has determined it. The latter species does not occur in New York.

**HELIX MULTILINEATA** SAY .....vol. ii. p. 103, pl. iii.

*Helix multilineata* SAY, (Binney ed.) p. 15.

DEKAY, N. Y. Moll. p. 41. pl. iii. fig. 24.

PFEIFFER, Symb. ad Hist. Hel. i. 41; Mon. Hel. Viv. i. 290; iii. 269.

CHEMNITZ, ed. 2, ii. 41, pl. lxxi. fig. 17-19, (1849).

REEVE, Con. Icon. No. 691, (1852).

DESHAYES, in Fer. i. 113, pl. l. c.

I have a variety of this with an open umbilicus. Another, received from Mr. I. A. Lapham, of Wisconsin, is small, of an uniform brownish-red, without any revolving lines.

Another resembles *H. Pennsylvanica* both in its general form and in the shape of the aperture. These, with those mentioned on p. 104, are the principal varieties. - The extremes of size among the specimens in my cabinet are 19 and 29 mill. in diameter.

The varieties mentioned by Pfeiffer and Deshayes are distinguished merely by the revolving bands. In a large suite of specimens it is rare to find two on which these bands and lines are similarly arranged.

It has been found at Lake Canadaigua, N. Y. (Slack).

**HELIX PENNSYLVANICA** GREEN.....vol. ii. p. 105, pl. vii.

*Helix Pennsylvanica* DEKAY, N. Y. Moll. p. 41, pl. iii. fig. 34.

CHEMNITZ, ed. 2, ii. 51, t. 73, fig. 4, 5. (*Excl. H. clausa*).

PFEIFFER, Mon. Hel. Viv. iii. 270. (*Excl. H. clausa*).

MRS. GRAY, Fig. Moll. An. pl. 291, fig. 5, absq. desc. (Ex. Bost. Journ.)

REEVE, Con. Icon. No. 676. (*Excl. syn.*)

BLAND, N. Y. Lyc. vi. 299; Notes 23.

*Helix Mitchelliana* DESHAYES, in Fer. i. 137, pl. xcvi. fig. 4-7, nec 13-16.

Green described this species in 1827, and deposited three specimens of it in the collection of the Philadelphia Academy, where they are still preserved. In 1837 another description and an excellent figure were published by Binney

in a well-known and widely circulating Journal. It is, therefore, surprising that so many authors and collectors have confounded it with *Helix clausa*, quite a distinct species. Such, however, has been the case, as a reference to the above synonymy will show. It is, however, well known under its correct name by means of the figures published by Binney, Reeve, and Chemnitz, ed. 2. Deshayes is the only one who has figured it under a wrong name.

Bland has carefully and correctly arranged the synonymy in his valuable "Notes."

Pfeiffer adds doubtfully to the synonymy *H. thyroidus* var. *edentula*. Beck, Ind. p. 23.

Has been found also in Illinois, (Kennicott).

The following is Green's description:—

Shell subglobose, spire elevated, whorls six or seven, with numerous oblique wrinkles or striæ, sutures deeply impressed, epidermis smooth, and of an olive-brown color, like most of the American *Helices*, umbilicus closed or masked, aperture slightly contracted at the base, a small callosity on the inner margin of the other lip, near its lower angle; shell rather more than  $\frac{1}{2}$  inch in diameter.

This shell resembles the *H. clausa* of Mr. Say, but may very readily be distinguished from that species by the closed umbilicus, the number of its whorls, and its general form. This shell is not uncommon near Charters Creek, Washington Co., Pa. I obtained five or six specimens with but very little trouble; associates with *solitaria*, *profunda* and *palliata*.

**HELIX CLAUSA** SAY... vol. ii. p. 107, pl. iv. (excepting the outline figures).

*Helix clausa* SAY, (Binney's ed.) p. 17, pl. xxxvii. fig. 1.

CHEMNITZ, Bibl. Conch. iii. 50, pl. xiii. fig. 2.

REEVE, fig. 694.

BLAND, N. Y. Lyc. vi. 336; Notes 27.

*Helix Pennsylvanica* PFEIFFER, Ex. parte, Symb. ad Hist. Hel. ii. 36; Mon. Hel. Viv. i. 291.

CHEMNITZ, ed. 2, ii. 51, ex parte.

REEVE, ex parte, No. 676.

*Helix Mitchelliana* CHEMNITZ, l. c. i. 332, pl. lvi. fig. 6-8.

I have differed from the opinion of *H. Mitchelliana* expressed on vol. ii. p. 109. My reasons for so doing will be found under that species. The outline figures representing it must, therefore, not be confounded with the central figures.

*H. clausa* Say has not been correctly described nor figured by any author but Say and Binney, until the last year, when it was correctly treated by Bland. DeKay has, indeed, described it as distinct from *Pennsylvanica*, but his figure is little characteristic, and his notes of its geographical distribution are incorrect. Reeve's figure referred to in the Synonymy may, perhaps, represent this species. In the text he confounds it with *Pennsylvanica*.

In the second edition of Chemnitz, Pfeiffer appears to have described and figured it, though he doubtfully refers it to *Mitchelliana*.

Say's original specimen is still preserved in the Academy of Natural Sciences.

The species occurs fossil in the Postpleiocene, and is found in the greatest profusion in some portions of the South, in what appears to be a semi-fossil condition. I have seen fresh specimens from Ohio, Indiana, Illinois, Kentucky (Kennicott), Missouri, Wisconsin, Mississippi, Alabama (Showalter).

The rounded, smoother variety, figured in the Boston Journal, may be distinguished from the following species principally by its perforation. There are forms, also, which nearly approach *H. bucculenta*.

#### HELIX MITCHELLIANA LEA.

##### PLATE IV. Outline figures.

T. superne obtuso-conicâ, inferne inflatâ, longitudinaliter et subtiliter striatâ, corneâ, diaphanâ, imperforatâ, anfr. 5 ; aperturâ subrotundatâ ; labro reflexo ; columellâ lævi.

Shell above obtusely conical, below inflated, longitudinally and



finely striate; horn color, transparent, imperforate; whorls 5; aperture nearly round; outer lip reflexed; columella smooth.

*Remarks.* I am indebted to Dr. Mitchell for this shell, which was sent to him by a friend from Ohio. It is rather larger than the *H. clausa* Say, and *H. jejuna* Say, but in form resembles them. It may be distinguished from the latter in not being perforate, and from the former in having a sharper lip. In its striæ it is distinct from both, in having them larger and much better defined.

*Hab.* Ohio. Diam. 7. Length .4 of an inch. [Lea].

#### SYNONYMS AND REFERENCES.

*Helix Mitchelliana* LEA, l. c.

TROSCHEL, Ar. f. Nat. 1839, ii. 221.

DEKAY, N. Y. Moll. p. 45.

PFEIFFER, Mon. Hel. V. i. 291; iii. 270.

BLAND, N. Y. Lyceum, vi. 339; Notes 29.

*Helix clausa* BINNEY, ex parte, p. 109.

In addition to the above synonymy, Pfeiffer and Bland quote doubtfully DeKay's figure of *clausa*. It is certainly little characteristic of either *Mitchelliana* or *clausa*.

Lea's figure is poor, and his remarks had better be entirely cancelled, having been written under a misapprehension of both the species referred to.

The figures I have referred to were intended to represent this species, and appear to me to do so. My friend Mr. Bland, however, refers them to *clausa*.

The shell figured by Deshayes under this name is *H. Pennsylvanica*. The figure in Chemnitz represents *H. clausa*. Anthony (Ohio Cat.) places *Mitchelliana* in the synonymy of *clausa*, and Kirtland (Ohio Rep.) seems to have catalogued it under the name of *Mitchella*.

I have never known this species to be found out of Ohio, where it appears to be not uncommon. It is readily distinguished from *clausa* by its more globose form and smooth, shining surface, its imperforate base, and by the following peculiarities pointed out by Bland. (l. c.)



"In *H. clausa* the umbilical region is more widely excavated, and the groove, behind the reflected lip, producing the contraction of the aperture, is continued at the base of the shell, becoming wider as it joins the umbilical opening. In *H. Mitchelliana* the groove is almost obliterated at the point of reflection of the lip over the umbilicus, by the more tumid character of the last whorl."

**HELIX BERLANDERIANA** MORICAND.....vol. ii. p. xlix. fig. 1.

*Helix Berlanderiana* DESHAYES, 3d ed. Lam. iii. 316.

CHEMNITZ, ed. 2, ii. 275, pl. cxxiii. figs. 15-18.

PFEIFFER, Mon. Hel. Viv. iii. 227, (nec. i.)

REEVE, Con. Icon. No. 708, (1852).

*Helix pachyloma* MENKE in Pfeiffer l. c. i. 323; Zeitschr. f. Mal. 1847, p. 32.

*Helix virginalis* PFEIFFER, Mon. Hel. Viv. iii. 132, i. 165 *sub nomine Berlanderianæ*.

CHEMNITZ, ed. 2, i. 260, pl. xxxviii. figs. 18, 19.

There is considerable confusion in the synonymy of this species, owing to the extreme varieties having been considered distinct species. I have never seen *H. virginalis*, but am persuaded by the description and figure published by Pfeiffer in Chemnitz that it is identical with *Berlanderiana*. I give below his description and on pl. 77, fig. 22, a fac-simile of his figure. Those persons who follow him in separating the two, will remove *H. virginalis* and its references from the above synonymy. In so doing, it must be borne in mind that the shell described by him as *Berlanderiana* in vol. i. of the Monograph, is in vol. iii. considered *virginalis*. (See also Zeitschr. f. Mal. 1848, p. 115.)

Pfeiffer acknowledges in vol. iii. that his *pachyloma* of vol. i. is the true *Berlanderiana*.

The shell figured on pl. 49 as *H. albozonata* will be treated under the following species.

The species is found also in Mexico.

Moricand's description is given below, as well as Pfeiffer's.

*Helix Berlanderiana*. H. t. globosa, perforata, lucida, alba vel cinerea, fascia unica, angusta cincta; labro exteriori crassiusculo, patulo. Long. 8, larg. 7 mill.—Mexique, dans Prov. de Texàs.

Cette coquille, tres voisine par sa forme de l'*H. tonelus*, Fer., est d'un blanc sale, formée de 5 tours, le sommet obtus; très-finement striée, les stries peu sensibles et très rapprochées; une bande étroite d'un gris clair, transparente, occupe le milieu du dernier tour et se prolonge sur le bord extérieur des tours de la spire; l'ouverture est semicirculaire; la levre intérieure peu apparente, l'extérieure plus épaisse que le reste de la coquille, renflée intérieurement par un bourrelet, qui la fait paraître évasée, le bord inférieur réfléchi sur l'ombilic dont il couvre la moitié. *Obs.* Les individus que j'ai reçus étaient tous dépouillés de leur épiderme.

*Helix virginalis*. T. umbilicata, depressa, striata, lucida, alba vel cinerea, interdum unifasciata; anfr.  $4\frac{1}{2}$  convexiusculi, ultimus basi inflatus; apertura lunato-subcircularis; perist. acutum, intus labiatum, margine columellari juxta umbilicum angustum vix reflexo. Diam. maj.  $8\frac{1}{2}$ , min.  $7\frac{1}{2}$ , alt.  $5\frac{3}{8}$  mill. Hab. in Texas. (Vid. pl. 77, fig. 22.)

#### HELIX GRISEOLA PFEIFFER.

PLATE XLIX. FIGURE 2. PLATE LXXVII. FIGURE 20.

T. umbilicata, depresso-globosa, oblique striatula, nitidula, grisea, cingulis pallidè fulvis, albo-marginatis circumdata; spira brevis; anfr.  $4-4\frac{1}{2}$  vix convexiusculi; umbilicus angustissimus; apertura lunaris; perist. simplex, album, reflexiusculum, margine columellari subexpanso. Diam. maj. 10, min.  $8\frac{3}{8}$ , alt. 6 mill. (Pfr.)

*Helix griseola* PFEIFFER, Symb. Ad. Hist. Hel. i. 41; Mon. Hel. Viv. i. 337, iii. 228.

REEVE, Con. Icon. No. 327, (1852).

CHEMNITZ, ed. 2, i. 342, pl. lx. figs. 17, 18.

*Helix cicercula* FERUSSAC in Mus. teste Pfeiffer.

*Helix splendidula* ANTON, Verz. p. 36, absq. desc. teste Pfeiffer.

*Helix albocincta* BINNEY, i. 128.

*Helix albozonata* BINNEY in tab.

*Brandybæna pisum* BECK, Index, p. 18, abs. desc. teste Pfeiffer.

This is the shell referred to in vol. i. as *albocincta*, on pl. 49, as *albozonata*, and by Gould, vol. iii. p. 34, as *albolineata*. It would probably have been described as

distinct from *Berlanderiana* had the author lived to finish his work. Pfeiffer has, however, given its specific weight. A fac-simile of his figure in Chemnitz is given (pl. 77, fig. 20).

My specimens are from Texas. It is quoted from Vera Cruz, Mexico, by Pfeiffer, who also specifies a Central American variety.

**HELIX HORTENSIS** MÜLLER.....vol. ii. p. 111, pl. viii.

*Helix subglobosa* DEKAY, N. Y. Moll. p. 31, pl. ii. fig. 14, pl. iii. fig. 39.

*nemoralis* STIMPSON, Shells of N. E. 54, (abs. desc.)

Inhabits also Greenland, (Mörch,) and perhaps Connecticut, (Linsley, Am. Journ. 48, 280).

**HELIX ASPERSA** MÜLLER.....vol. ii. p. 117, pl. lxxvii. fig. 4.

I am indebted for the shell figured to Dr. L. R. Gibbes, of Charleston, S. C.

**HELIX DIVESTA** GOULD.....vol. ii. pp. 122, 357, pl. xiii. a. fig. 2.

*Helix abjecta* PFEIFFER, Mon. Hel. Viv. iii. 270.

**HELIX VARIANS** MENKE....vol. ii. p. 123, pl. xlv; xlvii; lxxviii. fig. 22.

*Helix varians* MENKE teste Pfeiffer.

CHEMNITZ, ed. 2, ii. 221, pl. cix. figs. 1-5.

PFEIFFER, Mon. Hel. Viv. i. 238; iii. 183.

*Helix carnicolor* PFEIFFER, Symb. i. 37.

FERUSSAC Podr. 293 (absq. desc.)

DESHAYES, in Fer. i. 205, pl. xxix. A. figs. 14-17.

REEVE, Con. Icon. No. 283, (1852).

*Helix pisana* CHEMNITZ, ix. P. 2. p. 139. t. 132, fig. 1186. 87. Nec Müller.

FERUSSAC, Hist. l. c. ?

*Helix submeris* PFEIFFER, Mon. iii. 183.

*Helix rhodocheila* BINNEY, olim.

*Hemotrichus hæmostomus* SWAINSON, Malac. p. 165, f. 19. ?

In the Smithsonian Institute are specimens from Key Biscayne.

There can, I think, be no doubt of the identity of *H. polychroa* with *H. varians* of Porto Rico. Dr. Pfeiffer so decided after receiving authentic specimens from me.

Mighel's description of *submeris* is as follows.

Shell conic-globose, smooth, incremental striæ distinct, apex sub-acute; spire elevated, whorls  $5\frac{1}{2}$ , suture distinct, epidermis dark chestnut or mahogany colored, mottled, with an interrupted white zone around the body whorl; convex beneath, umbilicus minute, the region white; lip simple, thickened within; internal lip blending with the last whorl, and, with the inner margin of the outer lip, of a beautiful rose tint. Height  $1\frac{1}{2}$  inch; breadth the same; depth  $\frac{2}{3}$  inch. Hab. Key West, Florida.

Pfeiffer (l. c.) merely gives a Latin version of this description, never having seen the shell.

**HELIX ELEVATA SAY**.....vol. ii. p. 126, pl. iv.

*Helix elevata* SAY, (Binney's ed.) p. 27, pl. 37, fig. 2.

DEKAY, l. c. p. 36, pl. iii. fig. 20.

CHEMNITZ, ed. 2. i. 56, pl. vii. figs. 11, 12, (1846).

CHENU, Bibl. Conch. 3, 50, pl. xiii. fig. 2.

MRS. GRAY, Fig. Moll. An. pl. exci. fig. 7, *abs. desc.*

PFEIFFER, Symb. Hist. Hel. ii. 27; Mon. Hel. Viv. i. 217; iii. 270.

REEVE, Con. Icon. No. 681, (1852).

DESHAYES, in Fer. i. 329, pl. l. c.

*Helix Tennesseensis* TROSCHER, Ar. f. Nat. 1837, ii. 124.

PFEIFFER, Mon. i. 149; iii. 120, (*verba Leana*).

LEA, Tr. Am. Phil. Soc. ix. p. 1.

In the Boston Journal, this species is said to be also *Mesodon helicinum* Rafinesque. I can find no description of any such species.

The species occurs fossil in the Postpleiocene.

Mr. Robert Kennicott collected, in Wisconsin, two specimens of a curious variety of this species, furnished with a broad, revolving, brownish band on the body whorl.

I give below Lea's description of *H. Tennesseensis*. There can be no doubt of its being the young of this species. The authors referred to in the synonymy have merely repeated this description, without having seen the shell.



Testa supra plano-convexâ, subtus convexâ, luteâ, obliquè striatâ, umbilicatâ; spirâ brevi; suturis subimpressis; anfr. 5, subconvexis; aperturâ lunatâ; labro intus incrassato. Diam. .45. Length .32 inch.

### HELIX CLARKII LEA.

PLATE LXXVII. FIGURE 10.

T. supernè rotundatâ, infernè plano-convexâ, regulariter striatâ brunneo-corneâ, imperforatâ, unidentatâ: anfr. 7, obliquè striatis; aperturâ lunatâ, subdilatâ; labro albido, reflexo, infernè calloso; columellâ in medio unidentatâ, ad basim impressâ. (Lea).

#### SYNONYMS AND REFERENCES.

*Helix Clarkii* LEA, Proc. Acad. Nat. Sc. Phila. x. p. 41, March, (1858).

#### DESCRIPTION.

*Animal* not observed.

*Shell* imperforate, globosely-rounded, regularly and finely striated, reddish horn color; spire obtusely conic; whorls 7, convex, with delicate incremental striæ, the last one very globose and rounded below; aperture lunate; peristome white, thickened, reflected, its basal termination quite heavy and covering the umbilicus entirely; one elongated, white denticle on the parietal wall of the aperture.

Greater diameter 14; lesser 13; height 9 millimetres.

*Geographical Distribution.* Cherokee County, N. C.

*Remarks.* This is a distinct species. At first sight it seems a miniature *elevata*, but is at once distinguished by its peculiar globular shape.

The figure referred to is twice the natural size of the shell.

**HELIX THYROIDES** SAY.....vol. ii. p. 129, pl. xi.

*Helix thyroides* SAY, (Binney's ed.) p. 33, pl. xiii.

CHENU, Bibl. Conch. 3, 24, pl. iii. fig. 3.

DEKAY, l. c. p. 29, pl. ii. fig. 8.

MRS. GRAY, Fig. Moll. An. pl. 291, f. 6. (*Ex. Bost. Journ. absq. desc.*)

DESHAYES in Lam. 8d ed. 3, 309; in Fer. i. 209.

*Helix thyroides* CHEMNITZ, ed. 2, i. 331, pl. lviii. figs. 8, 9, (1850).

PFEIFFER, l. c. iii. 262.

REEVE, Con. Icon. No. 677.

*Anchistoma thyroides* ADAMS, Gen. pl. lxxviii. fig. 3.

I have followed Pfeiffer in the orthography of this species. Say's manuscript, also, shows the name proposed by him to have been *thyroides*.

I have specimens from nineteen States, showing some curious and apparently constant geographical varieties. One from Germantown, Pa., is very small, measuring only 15 millimetres in diameter. It is globose, shining, sometimes imperforate and generally without the parietal tooth. It is impossible to distinguish it from forms of *H. bucculenta*. Another peculiar form with an elevated, pointed spire and more triangular aperture inhabits St. Simon's Isle, Georgia, (Postell). The species is found in Louisiana and Texas, (Dr. Moore). It also occurs fossil in the Postpleiocene.

I am unable to find any description of *Mesodon leucodon* Rafinesque, quoted in the Boston Journal as a synonym. It is probable the name was sent to Ferussac by that author.

It is also mentioned by Petiver, No. 4, (l. c.)

**HELIX BUCCULENTA** GOULD,..... vol. iii. p. 9, pl. xi a.

*Helix bucculenta* PFEIFFER, Mon. Hel. Viv. iii. 271.

*Helix thyroides*  $\beta$  PFEIFFER, l. c. i. 345.

**HELIX EXOLETA** BINNEY,..... vol. ii. p. 131, pl. x.

*Helix exoleta* DEKAY, N. Y. Moll. p. 27, pl. ii. fig. 6.

*Helix albolabris*  $\delta$  PFEIFFER, Symb. ii. p. 22, absq. desc.

D. CHEMNITZ, ed. 2, i. 81, pl. x. figs. 19, 20.

*Helix zaleta* MRS. GRAY, Fig. Moll. An. pl. cxc. fig. 9.

PFEIFFER, Mon. Hel. Viv. i. 316; ii. 270.

DESHAYES, in Fer. i. 139.

REEVE, Con. Icon. No. 622, (1852).

Reeve (l. c.) considers the specific distinction of *exoleta*

as doubtful. Deshayes says that its anatomical details will decide the question. The dissections of Dr. Leidy have already done so.

'The species occurs in Georgia.

**HELIX DENTIFERA** BINNEY.....vol. ii. p. 184, pl. xii.

*Helix dentifera* DEKAY, N. Y. Moll. p. 34, pl. ii. fig. 17.

MRS. GRAY, Fig. of Moll. An. pl. cxc. fig. 11.

nec PFEIFFER, vol. iii.

nec CHEMNITZ.

This is not the *dentifera* described by Pfeiffer in the third volume of his Monograph, and the second edition of Chemnitz. The species there described and figured is *H. Röemeri*, confounded by Pfeiffer with *dentifera*. Its distinguishing features are pointed out in the succeeding article. A copy of Binney's descriptions is given in Mon. Hel. Viv. i.

It is a mountain shell, has been found by Mr. Edwards in Virginia, Dr. S. E. Shurtleff in Western Pennsylvania, Mr. Conrad at Broad Top Mountain, and Mr. Phillips on the Lehigh. Also in Maine, (E. S. Morse).

#### **HELIX ROEMERI** PFEIFFER.

##### PLATE LXXVII. FIGURE 3.

T. anguste umbilicata, depressa, tenui, confertim striatula, diaphana, vix nitidula, sordide carnea, spira vix elevata; sutura leviter impressa; anfr. 5 convexiusculis, ultimo peripheria subangulato; apertura obliqua, lunari; peristomate valide albolabiato, margine supero recto, basali reflexo, ad columellam in laminam tenuissimam, umbilicum semi-occultantem dilitato. (Pfeiffer).

##### SYNONYMS AND REFERENCES.

*Helix Röemeri* PFEIFFER, in Röemer's Texas, p. 455; Zeitschr. f. Mal. 1848, p. 117.

REEVE, Con. Icon. No. 680.

*Helix dentifera* PFEIFFER, Mon. Hel. Viv. iii. 269, (excl. Binney et DeKay).

CHEMNITZ, ed. 2, ii. 331, pl. cxxxi. figs. 1-3, (Excl. do.) nec BINNEY.

## DESCRIPTION.

*Animal* not observed.

*Shell* with a narrow, or partially covered umbilicus, depressed, rather thin, closely striated, rather transparent and smooth, horn-colored; spire slightly elevated; suture lightly impressed; whorls 5, rather convex, increasing slowly, the last one subcarinate at its periphery, scarcely descending; aperture lunar, oblique, generally slightly contracted by a parietal denticle which obliquely enters the mouth of the shell; peristome white, thickened, the upper portion hardly expanded, reflected below, and at the columellar junction spreading into a thin, partial covering to the umbilicus.

Greater diameter 21, lesser 18, height 10 mill.

*Geographical Distribution.* New Braunfels, Texas, (Pfeiffer), Washington Co. (Moore).

*Remarks.* This species is confounded by Pfeiffer with *H. dentifera*, an authentic specimen of which he has not seen. It is quite a distinct species and inhabits a distinct geographical region. It may be distinguished from *dentifera* most readily by attention to the following particulars. Its umbilicus is generally but partially covered, while *dentifera* is always imperforate, its color is lighter, its surface smoother, and above all, its lip is not so broadly reflected; it is also distinctly subcarinate at the periphery.

The shell is described as "*tenuis*," and so appears in the figure in Chemnitz. I have specimens quite solid. This figure is erroneously referred to *dentifera*, under which name Pfeiffer in the third volume of his Monograph and in Chemnitz describes *Röemeri*.

**HELIX PALLIATA** SAY..... vol. ii. p. 136, pl. xiv.

*Helix palliata* SAY, (Binney's ed.) p. 16.

DEKAY, N. Y. Moll. 33, pl. iii. fig. 36, (Excl. a. b.)

CHEMNITZ, ed. 2, i. 359, pl. lxii. figs. 15, 16, (1849).

PFEIFFER, Mon. Hel. Viv. i. 316; iii. 267.



MRS. GRAY, Fig. Moll. An. pl. 193, fig. 8. Ex. Boston Journal,  
(absq. desc.)

DESHAYES, in Fer. i. 144, (excl. var.)

REEVE, Con. Icon. No. 678.

*Helix denotata* DESHAYES, l. c. 3d ed. iii. 309.

The extreme variation of this species has given rise to considerable confusion. I propose to designate as a prominent variety **HELIX CAROLINENSIS** LEA, which is considered as a variety only by Ferussac, DeKay, Binney, Chemnitz, Pfeiffer, Deshayes, and Reeve. The first mentioned of these authors says, "This is *H. palliata* Say, and my "*denotata*," (Bull, Zoöl. 1835, § 2, p. 100). Say is, I think, wrong in referring Lea's figure and description to *Helix appressa* var. *a*, (vid. Binney's ed. 36).

*Triodopsis scabra* Rafinesque is quoted by Binney (Boston Journal) and others as a synonym of this species. I know of no description of such a species. The generic definition of *Triodopsis* (vol. i. 49) will not apply to *palliata*.

I have found it in Vermont at Copperas Hill.

The succeeding article will contain my views of *Helix obstricta*, and *Caracolla helicoides*, which I have not retained in the synonymy of *palliata*.

#### HELIX OBSTRACTA SAY.

##### PLATE XV.

Shell depressed, with elevated lines forming grooves between them; epidermis pale brownish, naked; volutions five, depressed above, beneath rounded, with an acute, projecting carina; umbilicus covered with a white callus, indented; mouth resembling that of *H. palliata*.

Inhabits Ohio. Breadth nearly one inch.

This species is very closely allied to *Helix palliata*, but the epidermis is not covered with small elevations as in that shell, and the carina is very prominent and remarkable.

## SYNONYMS AND REFERENCES.

*Helix odstricta* SAY (Binney's ed.) p. 17.

PFEIFFER, Mon. Hel. Viv. i. 317; iii. 267.

REEVE, Con. Icon. No. 683, (1852).

*Helix palliata* var. a SAY (Binney's ed.) p. 16.

Var. a b DEKAY, N. Y. Moll. p. 33, pl. ii. fig. 16.

Var. BINNEY, l. c.

*Helix appressa* var. DESHAYES in Fer. (*in tab. non in textu.*)

*Helicodonta denotata* var. FERUSSAC, Tab. Syst. 38; Hist. pl. L. A. fig. 7, *absq. desc.*

*Caracolla helicoides* LEA, l. c.

*Remarks.* This species is considered by Say, Binney, and DeKay as a variety of the preceeding. It appears to me, however, sufficiently constant in its characteristics to be considered distinct.

I have added to the synonymy of this species *H. palliata* var. a Say. His description seems to agree with that of *obstricta* given above.

Var. a. A very prominent acute carina; destitute of minute prominences. Inhabits Ohio. Breadth nearly one inch.

Ferussac figured this species, l. c., without describing it. In Deshayes's continuation of the Histoire no mention is made of it, the figure being erroneously referred to *H. appressa* var. in the explanation of the plates.

As regards *Caracolla helicoides*, I think there can be no doubt of its identity with *obstricta*. Specimens received from Mr. Lea under this name are, however, furnished with the "minute protuberances" which Say describes as not present on *obstricta*. I believe they are not constant. Ferussac says that *Caracolla helicoides* is the same as the carinated variety of *palliata* (Bull. Zoöl., 1835, § 2, p. 100). His figure is certainly the same as that of Lea and Reeve. Say declares *Caracolla helicoides* to be the same as his *palliata* var. a (Binney's ed. p. 36).

Anthony (Ohio Cat.) places *obstricta*, *Carolinensis* and *helicoides* in the synonymy of *palliata*. Pfeiffer considers *helicoides* a synonym of *obstricta*. In the Boston Journal,

Binney erroneously quotes Say as describing *obstricta* with only one tooth on the outer lip.

The species is found fossil in the Postpleiocene at Natchez, and recent in Ohio and Tennessee.

**HELIX APPRESSA** SAY.....vol. ii. p. 140, pl. xiii.

*Helix appressa* SAY (Binney's ed.) 15.

PFEIFFER, l. c. iii. 267.

REEVE, Con. Icon. No. 689, (1852).

DESHAYES in Fer. l. c. i. 141.

*Helix linguifera* DESHAYES, in Lam. 2d ed. viii. 70; 3d ed. iii. 293.

PFEIFFER, Symb. ad Hist. Hel. p. 19, (*absq. desc.*)

CHENU, Ill. Conch. pl. xii. fig. 5.

DELESSERT, Recueil, pl. xxvi. fig. 5.

I have received from Illinois large quantities of Say's var. a. of this species, collected by Mr. R. Kennicott. It is thus described by Say:—"Labrum with two projecting angles."

**HELIX INFLECTA** SAY.....vol. ii. p. 143, pl. xlv. fig. 3.

*Helix inflecta* SAY (Binney's ed.) p. 16.

DEKAY, N. Y. Moll. p. 45.

Mrs. GRAY, Fig. Moll. An. pl. 193, fig. 7. (Ex. Bost. Jour. absq. descr.)

*Helix clausa* DESHAYES in Lam. 3d ed. 3, 309; in Fer. Hist. l. c. i. 143.

REEVE, Con. Icon. No. 704, (1852).

PFEIFFER, l. c. iii. 269.

*Xolotrema clausa* RAFINESQUE, Enumeration, &c. p. 3, (1831).

The young of this may, perhaps, be *H. porcina* Say (vid. *H. hirsuta*).

Pfeiffer mentions a Texan variety, smaller, "umbilico non omnino clauso."

It is a typographical error on p. 33, vol. iii. to call this *H. triodonta* Jahn.

Rafinesque thus describes *Xolotrema clausa*, "Subdepressed, 5 spires a little striated, opening almost hidden." \*

\* It is frequently argued that the descriptions of this author are indefinite. To do justice to him one should pay attention to his remark, that if one does not admit his generic distinctions "it would be requisite to repeat, in the descriptions of their specific characters, that of the characters of my new genera, which would render the definition of the species prolix." Tr. of Mon. p. ii.

I have specimens of this species from the following additional States, — Pennsylvania, Georgia, Louisiana.

**HELIX RUGELI** SHUTTLEWORTH.....vol. iii. p. 18, pl. lxxviii. fig. 15.

*Helix Rugeli* SHUTTLEWORTH, Bern. Mittheil. 1852, p. 198.

PFEIFFER, Mon. Hel. Viv. iii. 268.

I am indebted to Bishop Elliott for specimens of this shell. It is in most respects similar to the preceding species, and would be mistaken for it unless the aperture be examined. The position of the upper tooth of the peristome far within the aperture at once distinguishes it. The size is not, however, any criterion, as I have individuals of *Rugeli* only 10 millimetres in diameter, while some of my specimens of *inflecta* are full 13 millimetres.

The plate shows an enlarged view of the aperture.

**HELIX MONODON** RACKETT.....vol. ii. p. 147, pl. xli.

*Helix monodon* DEKAY, N. Y. Moll. p. 35, pars., excl. syn., pl. iii. fig. 19 — not fig. 21, a. b.

Mrs. GRAY, Fig. Moll. An. pl. 193, fig. 11. (Ex. Bost. Journ. abs. desc.)

BILLINGS, Canadian Nat. ii. 100, fig. 6.

*Helix convexa* CHEMNITZ, pars. (excl. syn. et tab. lxvi. figs. 24, 27).

PFEIFFER, l. c. iii. 268, (excl.  $\beta$  et  $\gamma$ ).

DESHAYES, Lam. 3d ed. iii. 308; in Fer. l. c. i. 144.

REEVE, Con. Icon. No. 696 (1852), excl. syn.; No. 717, (1854).

*Helicodonta hirsuta a.* FERUSSAC, Tabl. Syst. 101.

#### VAR. FRATERNA SAY.

*Helix fraterna* SAY (Binney's ed.) p. 30, pl. lxxiv. fig. 3.

Mrs. GRAY, Fig. Moll. An. pl. 193, fig. 5 absq. desc. (Ex. Bost. Journ.)

*Helix monodon* DEKAY, l. c. ex parte, pl. iii. fig. 21, a, b.

WOOD, Ind. Suppl. vii. 15.

*Helix convexa* CHEMNITZ, ed. 2, i. 86, ex parte.

Var. REEVE, Con. Icon. l. c.

$\beta$  PFEIFFER, l. c.

#### VAR. LEAII WARD.

*Helix convexa*  $\gamma$  PFEIFFER, l. c.

Var. CHEMNITZ, l. c. pl. lxvi. figs. 24, 25.



I have separated the synonymy of these varieties in such a way as to show the opinion of various authors on them. For my own part, I cannot consider them as distinct species. Mighels (Shells of Maine) considers *fraterna* and *monodon* distinct.

It has also been noticed in Washington Co. Texas, (Moore).

**HELIX STENOTREMA** FERUSSAC.....vol. ii. p. 151, pl. xlii. fig. 5.

*Helix stenotrema* PFEIFFER, Symb. ii. 39, (excl.? *pustula*.)

REEVE, No. 720, (1852).

*Helix hirsuta*  $\beta$  PFEIFFER, Mon. Hel. Viv. i. 421.

Var. *Stenotrema*, CHEMNITZ, ed. 2, i. 376 (1846), pl. lxx. figs. 12-14, (1849).

*Helicodonta hirsuta a* FERUSSAC, l. c. pl. L. A. fig. 3.

I have thought it best to separate this from the succeeding species, its characteristics being constant in Postpleiocene fossils as well as in recent individuals from Indiana, Kentucky, Mississippi, Georgia, Alabama, and Louisiana.

Ferussac considers this as var. a of *hirsuta* and gives *Stenotrema convexa* Rafinesque as a synonym. His figure is unmistakable. It appears, therefore, that *Stenotrema convexa* Rafinesque is not *hirsuta* but the heavy form. Its description in addition to that of the genus given in vol. i. is as follows: "Nearly round, both sides convex, smooth, 5 spires." I cannot, therefore, see any reason for considering Rafinesque's species to be *monodon*, as so many writers have done. In the continuation of the *Histoire*, Deshayes considers *stenotrema* as a variety only. He has caused confusion by quoting *Stenotrema convexa* Rafinesque as a synonym of *hirsuta*, and yet saying that the same author has given the name of *convexa* to the shell figured on pl. L. A. fig. 2, which is *monodon*.

Pfeiffer also, in vol. i., gives *Stenotrema convexa* Raf. as a synonym of *monodon*, on the authority of Ferussac, though a reference to his figure would at once show that he applied the name to the heavy form of *hirsuta*.

Gould quotes *Stenotrema convexa* as a synonym of *hirsuta* (Invert. l. c.)

**HELIX HIRSUTA** SAY.....vol. ii. p. 150, pl. xlii. fig. 3.

*Helix hirsuta* SAY (Binney's ed.) p. 8.

DE KAY, N. Y. Moll. p. 36, pl. iii. fig. 27.

DESHAYES, in Lam. ed. 3, vol. 3, p. 308; in Fer. i. p. 140.

Mrs. GRAY, Fig. of Moll. An. pl. 193, fig. 8, ex Bost. Journ.

CHEMNITZ, ed. 2, Excl. var., i. 374 (1846), pl. lxxv. fig. 9-11, (1849).

PFEIFFER, Mon. Hel. Viv. Excl. var.  $\beta$ , i. 421; iii. 126.

REEVE, Con. Icon. No. 714, (1852).

*Helix sinuata*  $\gamma$  GMELIN (teste Pfeiffer).

*Helix isognomostomos*  $\gamma$  GMELIN (teste Pfeiffer).

*Tridopsis hirsuta* WOODWARD, Man. pl. xii. fig. 7, absq. desc.

*Stenostoma convexa* RAFINESQUE, Enum. and Acc. p. 3, 1831, nec. Ferussac.

Junior?

*Helix porcina* SAY (Binney's ed.) p. 30, pl. lxxiv. fig. 2.

DEKAY, N. Y. Moll. p. 45.

PFEIFFER, Mon. Hel. Viv. iii. 97.

BLAND, N. Y. Lyceum, vi. p. 344, Notes, i. 34, with fig.

In the remarks on the preceding species will be found some notes referring equally to this.

The species is found fossil in the Postpleiocene, and recent in the localities already mentioned, as well as in Kansas (Hayden), Virginia, at the height of 2000 above the sea (Edwards), and the District of Columbia (Stimpson).

The generic description of *Stenostoma* or *Stenotrema* is given in vol. i. p. 49. The only specific description is the following: "Nearly round, both sides convex, smooth, 5 spires, Kentucky." It appears to me to apply more to this species than to *monodon*.

As regards *H. porcina*, Say's description is copied by the authors referred to, neither having seen authentic specimens. Bland refers it rather to *inflecta* than *hirsuta*, if a young shell, but anticipates its proving mature. From the figure of Say, I do not doubt the correctness of my father's view of this question. Other cases occur among Say's writings of still graver errors than describ-

ing a young shell as mature; compare, for instance, his description of the young of a common *Planorbis* as *Bulla fluviatilis* (Binney's ed. p. 71).

Say's description is as follows:—

Shell depressed, yellowish brown; epidermis rugose, with minute, very numerous bristles; whorls rather more than four, depressed above, beneath rounded, forming a very obtuse angle rather above the centre of the whorl; umbilicus open, rather small, profound; labrum simple.

Breadth rather more than three tenths of an inch. Inhabits the North-West Territory.

**HELIX BARBIGERA** REDFIELD.....vol. iii. p. 21, pl. lxxvii. fig. 2.

*Helix barbigera* REDFIELD, N. Y. Lyceum, vi. 171, pl. ix. figs. 4, 5, 7.

The figures referred to are fac-similes of those of Redfield, showing the outline of the shell, as well as a magnified view of a portion of the epidermis.

#### **HELIX EDWARDSI** BLAND.

PLATE LXXVIII. FIGURES 7, 9.

T. imperforatâ, lenticulari, carinatâ, tenuiusculâ, fulvâ; epidermide castaneâ, supra in striis pilosis prostratis minutis elevatâ,—infra tuberculis acutis minutis creberrime munitâ, quæ juxta aperturam setos erectos gerunt; spirâ convexo-conoideâ; anfr. 5, complanatis, lente accrescentibus; ultimo antice gibbo, subito subdeflexo; apice minute granulato; basi convexo, parum indentatâ, lineis numerosis spiralibus sub epidermide impressis; suturâ profunde impressâ; aperturâ obliquâ, transversâ, auriformi; dente angustâ, subarcuatâ, lamelliformi, prælongâ, parietis aperturalis coarctatâ; perist. margine supero acuto, parum reflexo, infero subarcuato, depresso, subreflexo, et ad anfractum ultimum subappresso, callo dentiformi intus instructo, obsolete inciso.

#### SYNONYMS AND REFERENCES.

*Helix Edwardsi* BLAND, N. Y. Lyceum, vi. p. 277; Notes, p. i. pl. ix. fig. 14-16.

#### DESCRIPTION.

*Shell* imperforate, lenticular, carinate, the carina obsolete near the aperture, rather thin, beneath the epidermis pale brown; the

epidermis dark chestnut-color, with numerous minute curved hair-like processes lying flat upon, and attached to the epidermidal surface of the upper whorls in the direction of the incremental striæ, the epidermis at the base covered with acute, raised, transverse tubercles, most numerous, and having erect bristles near the aperture; spire convex-conoid; whorls five, flattened, gradually increasing, the last gibbous above, suddenly but slightly deflected; apex minutely granulate; base convex, little indented in the umbilical region, and with impressed spiral-lines beneath the epidermis; suture deeply impressed; aperture oblique, transverse, auriform, narrowed by a slender slightly arcuate lamelliform parietal tooth extending across from the umbilical axis, and terminating with a short angular deflection within the aperture; upper margin of the peristome acute, scarcely reflected, lower margin slightly arcuate, depressed, slightly reflected, and partially appressed to the body whorl, with a tooth-like callus within, having an almost obsolete notch in the centre.

Diam. maj. 9, min. 8, alt. 5 mill.

*Geographical Distribution.* Mountains in Fayette, or Green Briar Co., Virginia. (W. H. Edwards?)

*Remarks.* This species is allied to or rather intermediate between *H. barbigera* Redf. (Plate IX. figs. 4-7), and *H. hirsuta* Say — the former connecting *H. spinosa* Lea with *H. fraterna* Say. It is smaller, more elevated, less acutely carinated, and readily distinguished from *H. barbigera* by the partially appressed, notched peristome, and the different character of the epidermis. In *H. barbigera* the attached hair-like epidermidal processes are produced, at the sutures and carina, into cilia, which are entirely wanting in this species. The same processes, though less numerous, and sometimes almost obsolete, are observable at the base of the former, while in the latter, the basal epidermis approaches in character to that of *H. palliata* Say. The deep characteristic notch in *H. hirsuta* is considerably less developed in *H. Edwardsi*, and the callus which connects the parietal tooth with the upper margin of the peristome in the former, does not exist in the latter. In the general character of the peristome the species under consideration resembles *H. hirsuta*, while *H. barbigera* is in that particular more appropriately compared with *H. fraterna* Say.



While naming this species after my friend Mr. Edwards, who collected it, I am quite aware of the objections to such specific names, but in the Genus *Helix* it seems almost a hopeless case to find, for a shell closely allied to several others, an unpreoccupied name derived from any distinct specific character.

This is Bland's description. I have also given fac-similes of his figures.

**HELIX SPINOSA** LEA.....vol. ii. p. 154, pl. xlv. fig. 1.

*Helix spinosa* DEKAY, N. Y. Moll. p. 47.

PFEIFFER, l. c. iii. 126.

CHEMNITZ, ed. 2, i. 375, pl. lxx. figs. 15-17, (1849).

REEVE, Con. Icon. No. 685, (1852).

**HELIX EDGARIANA** LEA.....vol. ii. p. 155, pl. xlv. fig. 2.

*Caracolla Edgariana* TROSCHER, Arch. f. Nat. 1843, 2, p. 124.

*Helix Edgariana* PFEIFFER, Mon. Hel. Viv. i. 425; iii. 126.

REEVE, Con. Icon. No. 703.

I have specimens of this species from Tennessee (Elliott), Waschita Springs, Arkansas (Binney coll.), and Alabama, (ditto).

**HELIX MAXILLATA** GOULD.....vol. ii. p. 157, pl. xl. a, fig. 2.

*Helix maxillata* PFEIFFER, Mon. Hel. Viv. iii. 126.

The impressions of this plate are printed from two separate copper plates. On one of them, the enlarged view of the aperture of this species is misplaced.

It has also been detected by Dr. H. M. Neisler along the Cattahoochee River in Georgia.

**HELIX CONCAVA** SAY.....vol. ii. p. 163, pl. xxi.

*Helix concava* SAY, (Binney's ed.) p. 20.

*Helix planorboides* PFEIFFER, Mon. Hel. Viv. iii. 156.

CHEMNITZ, ed. 2, ii. 164, pl. xciv. fig. 17-19; cliv. fig. 45, (1851).

REEVE, Con. Icon. No. 674, (1852).

DESHAYES, in Fer. l. c. i. p. 87.

*Helix dissidens* DESHAYES, l. c. i. 97, pl. 84, figs. 1, 2.

PFEIFFER, l. c. iii. 84.

The variety referred to as larger and from beyond the Rocky Mts. by Adams (l. c.), is *H. Vancouverensis* Lea.

I can find no description by Rafinesque of this species, though he is quoted by Binney in the Boston Journal, probably on the authority of Ferussac.

Pfeiffer (Mal. Blatt. ii. p. 11) points out the error made on p. 164 in referring to this species the figure in the Boston Journal.

It has also been found in Maine (Morse), as well as various other new localities, and occurs fossil in the Post-pleiocene.

*Helix dissidens* appears to me identical with this species. I have given a fac-simile of the figure of Deshayes (pl. lxxvii. fig. 5), and also subjoin his remarks, as well as description. Pfeiffer repeats the last, not having seen the shell, and notes the resemblance to *H. Vancouverensis* (*vellicata*).

HELIX DISSIDENS. Testa orbiculato-depressa, superne convexa sub-tus late et profunde umbilicata; anfr. convexiusculis, ultimo cylindraceo; apertura rotundato-lunari, obliqua; labro simplici, superne inflexo; testa concolore, albo-viridula.

Diam. 17, alt. 7. Habite l'Amerique Septentrionale.

Nous soupçonnons que cette espèce a été confondue par les conchyliogues Américains avec notre *H. cellaria* d'Europe. Quoique très voisines, ces espèces se distinguent cependant par des caractères constants. Celle-ci est orbiculaire, très aplatie, à spire convexe, très obtuse, composée de  $5\frac{1}{2}$  tours convexes, réunis par une suture déprimée. Le dernier tour est cylindrée, un peu plus large en dessous qu'en dessus; il est percé au centre d'un très grand ombilic, dont le diamètre est égal à celui du dernier tour. L'ouverture est obronde, semilunaire; elle est légèrement déprimée du haut en bas; son diamètre transversal se trouve ainsi un peu plus long que le diamètre longitudinal. Les bords de cette ouverture restent simples; ils sont plus obtus et plus épais que dans *H. cellaria*, et dans le plupart des autres espèces du groupe. Quoique polie et brillante, cette coquille n'est par cependant tout à fait lisse: on remarque,

en effet, sur sa surface des stries irrégulières d'accroissement, qui grossissent en s'approchant de l'ombilic, se régulaissent dans cette cavité, et deviennent assez semblables à celle qu'on remarque dans quelques *solarium*. Cette coquille est mince, diaphane, et d'une couleur uniforme, d'un jaune verdâtre très pâle. Les stries qui s'enforcent dans l'intérieur de l'ombilic n'ont pas été représentées assez grosses dans les figures de cette ouvrage, auxquelles nous renvoyons.

**HELIX JEJUNA** SAY.....vol. ii. p. 172, pl. xlii. fig. 2.

*Helix jejuna* SAY, Journ. Acad. ii. 158; Binney's ed. p. 9.

DEKAY, N. Y. Moll. p. 46.

PFEIFFER, Mon. Hel. Viv. i. 147; iii. 124.

BLAND, N. Y. Lyceum, vi. p. 341; Notes 31.

*Helix Mobiliana* TROSCHEL, Ar. f. Nat. 1843, ii. 124.

PFEIFFER, l. c. iii. 219.

This species is not referred to under this name in the second volume of the Mollusks. Of all the authors referred to in the synonymy, none have seen authentic specimens of it. It has been known only by Say's description until within a few months past, when it was suggested to me by Dr. Pfeiffer that it might be identical with *Mobiliana*. Specimens found at the original locality\* by Mr. O. S. Dorman, agree with Say's description sufficiently to convince Bland of their identity. Since there is no hope of ever deciding the question with certainty, it appears best to follow the suggestion of these two authors, as that most likely to be correct.

In notes taken by Dr. Binney at the Jardin des Plantes, it appears that a young shell is there labelled *H. jejuna*.

Lea refers to this species in his remarks on several species. As demonstrated by Bland, he had before him *clausa* under this name.

Anthony makes *Mobiliana* a synonym of *clausa* in his Ohio Catalogue.

\* Mr. Dorman writes that the correct orthography of the spot is *Cowford*, and not *Cowfort*.

Living specimens sent me by Bishop Elliott present the following characteristics : —

Animal dirty white, neck darker, superior tentacles black, — not quite twice the breadth of the shell, — foot pointed.

It has also been found at St. Simon's Isle, Ga. (Postell), St. John's River and St. Augustine, Fla., (Dorman), and in the cemeteries of Savannah. (Elliott.)

The following is Say's description : —

*H. JEJUNA*. — Shell subglobular, glabrous, pale reddish brown ; volutions five, slightly wrinkled, regularly rounded ; spire convex ; suture rather deeply impressed ; aperture dilate lunate ; labrum a little incrassated within, not reflected ; umbilicus open, small.

Breadth rather more than one fifth of an inch. Inhabits the Southern States.

Animal — light reddish brown, with a granular surface, longer than the breadth of the shell ; oculiferous tentacula elongated, and rather darker than the body.

This shell is very closely allied to *H. sericea* of Southern Europe, but it differs from that species in being destitute of the hirsute vesture. I found several specimens of *jejuna*, during an excursion some time since into East Florida, at the Cow Fort on St. John's River. It is in the collection of the Academy.

**HELIX INCRUSTATA** POEY.....vol. ii. p. 174, pl. xxix. a, fig. 4.

*Helix incrustata* POEY, *Memorias*, vol. i. pp. 208, 212, pl. xii. figs. 11-16.

PFEIFFER, *Mon. Hel. Viv.* iii. 632.

This shell is described by Gould under the name of *saxicola*. It is, however, quite a distinct species. The true *saxicola* is more nearly allied to *chersina*, and its surface is bright and clean, the spire elevated, the general outline more globose, and the umbilicus small, being also slightly covered by the lip.

I am indebted to Mr. Poey for specimens of the true *saxicola* of Cuba, as well as of his *incrustata*. A compari-



son of the latter with the shell described by Gould, leaves no room for doubting their identity. Poey's description is as follows :—

Testa depressa, tenuis, corneo-fusca, perspectivè perforata, subtiliter striata; anfr. 4½, ultimo convexo, prioribus planulatis; apertura subcircularis, marginibus acutis approximatis.

**HELIX PULCHELLA** MÜLLER.....vol. ii. p. 175, pl. xvii. fig. 1.

*Helix minuta* SAY, (Binney's ed.) p. 30.

STIMPSON, Shells of N. E. p. 54, absq. descr.

I have in my possession notes of Say never published, in which he acknowledges the identity of these two species. DeKay considers them distinct, but erroneously says the European *pulchella* is furnished with sharp parallel ribs, (referring to the variety). Stimpson also considers them distinct.

Ferussac, Pfeiffer, Deshayes, and Reeve unite them.

I am constantly receiving this species from every section of the country,—having specimens from the following new localities: Pennsylvania, District of Columbia, Michigan (Winchell), Kansas and Nebraska (Hayden), and Florida. It is brought down in immense quantities by the streams of Nebraska and Kansas, and deposited with drift-wood, other minute shells, &c., on their banks. Dr. Hayden collected myriads of them during his expedition to the Yellow-stone River. He was also so fortunate as to find about a pint of the heavily ribbed variety (*H. COSTATA*), which had before been noticed only at Cincinnati and Philadelphia, and that very sparingly. The discovery of this ribbed variety was a most interesting one, as it gives additional evidence of the identity of the American with the European *pulchella*, and is strongly opposed to the theory of the introduction of the species from abroad.

**HELIX PROFUNDA** SAY.....vol. ii. p. 177, pl. xxii.*Helix profunda* SAY, (Binney's ed.) pp. 20, 36, pl. 37, fig. 3.

DEKAY, N. Y. Moll. p. 42, pl. iii. fig. 38.

CHEMNITZ, ed. 2, ii. p. 63.

PFEIFFER, l. c. iii. 265.

CHENU, Bibl. Conch. iii. 51, pl. xiii. fig. 26.

DESHAYES in Fer. i. 69.

REEVE, Con. Icon. No. 682, (1852).

MRS. GRAY, Fig. Moll. An. pl. cxciii. fig. 12. (Ex. Bost. Journ.)

*Helix Richardi* DESHAYES in Lam. 3d ed. iii. 283.

CHENU, Ill. Con. xii. 13.

DELESSERT, Rec. des Coq. pl. xxvi. fig. 7.

*Polygyra profundum* ADAMS, Gen. Rec. Moll. ii. 207, (absq. desc.)?

The shell figured in Ferussac, pl. 69 G, figs. 9, 11, and referred to as var.  $\beta$  by Pfeiffer, is merely one of the many varieties of the species.

I have a specimen collected by Mr. T. A. Conrad on Broad Top Mountain, Pennsylvania. It occurs fossil in the Postpleiocene.

**HELIX SAYII** BINNEY.....vol. ii. p. 180, pl. xxiii.*Helix Sayii*, CHEMNITZ, ed. 2, No. 976, tab. cxlviii. figs. 13, 14.

MRS. GRAY, Fig. Moll. An. pl. 193, fig. 10. (Ex. Bost. Journ.)

DESHAYES in Fer. i. p. 79.

REEVE, Con. Icon. No. 679, (1852).

*Helix diodontia* SAY, (Binney's ed.) p. 39, pl. lxxiv. fig. 4.

DEKAY, N. Y. Moll. p. 34, pl. ii. fig. 18.

I have it also from Pennsylvania.

**HELIX TRIDENTATA** SAY.....vol. ii. p. 183, pl. xxvii.*Helix tridentata* SAY, (Binney's ed.) p. 6, pl. lxx. fig. 1.

DEKAY, N. Y. Moll. p. 28. pl. ii. fig. 7.

POTIEZ et MICHAUD, Gal. p. 114.

MRS. GRAY, Fig. Moll. An. pl. 291, fig. 3. (Ex. Bost. Journ.)

CHEMNITZ, l. c. i. 84.

PFEIFFER, l. c. iii. 263.

DESHAYES in Lam. ed. 3, iii. 309, in Fer. l. c. i. 72.

REEVE, Con. Icon. No. 690, (1852).

*Triodopsis lunula* RAFINESQUE, En. and Acc. p. 3.

I propose to separate from *tridentata* Binney both *fallax* and *Hopetonensis*. Their distinctive characters are suf-

ficiently strong and constant to warrant the separation, though many intermediate forms occur, scarcely referable to one more than to another. The present form occurs less plentifully in the Southern States, its place being filled by the two others.

Petiver's No. 6, is this species. *Triodopsis lunula* is also one of its synonyms. The generic description is given (vol. i. p. 49),—the specific description is as follows:—

Depressed, mouth narrow with thick lips, umbilicus lunulated. In Kentucky. Forms subgenus *Menomphis*.

In Ravenel's Catalogue, p. 9, (1834), a variety of *H. tridentata* is mentioned under the name of *ephebus*. I find among Say's manuscript the following description of it:—

*H. TRIDENTATA* S. var. *ephebus*. Small; labrum much more obtusely rounded; the elevated lines of the whorls more prominent and obvious. Breadth two fifths of an inch.

**HELIX FALLAX** SAY.....vol. ii. p. 183, pl. xxviii.

*Helix fallax* SAY, (Binney's ed.) p. 27.

DEKAY, N. Y. Moll. p. 28, pl. iii. fig. 23.

CHEMNITZ, l. c. i. 364, (1846).

PFEIFFER, l. c. iii. 263.

REEVE, Con. Icon. No. 686, (1852).

*Helix tridentata* BINNEY, Bost. Journ. l. c. pl. xviii. fig. 3.

This is certainly more than a variety of *tridentata* Say. Not only are the characteristic differences well marked, but the habits of the respective animals are different. Mr. J. G. Anthony tells me that *tridentata* is found on hill-sides in the grass, while *fallax* inhabits rich soils, in woods, under logs, and is not gregarious like the former. The difficulty is to mark the dividing line between the many varieties of *fallax*, some of which are quite as distinct as *H. Hopetonensis* Shuttl.

The shell mentioned on page 10 of my Notes as being furnished with an internal fulcrum, seems to be a distinct species.

I have specimens of *fallax* from the Northern,<sup>1</sup> Western, and Southwestern States. It is also found in many of the Southern States, and is quoted from Texas by Röemer. Say's description is as follows : —

**HELIX FALLAX.** Spire convex; volutions five, with elevated lines forming grooves between them; labrum reflected, contracting the aperture, bidentate; teeth separated by a profound sinus; superior tooth inflected into the mouth; inferior tooth situated near the base; labrum with a large, prominent, oblique, lamelliform tooth, curving downwards so as nearly to reach the termination of the labrum; umbilicus open, exhibiting the volutions.

Greatest transverse diameter nine-twentieths of an inch.

This resembles the *tridentata* Nob., but the upper tooth of the labrum is much inflected, the spire is more elevated, and the size is less considerable; in the former character it coincides with *H. inflecta* Nob., but that shell has the umbilicus closed.

Presented to the Academy by Messrs. Hyde and Mason, who found it in the vicinity of Philadelphia, where it is not uncommon.

Since the above was written, I received a specimen from Mr. Stephen Elliott, of South Carolina, fully equal in size to the *tridentata*.

**HELIX HOPETONENSIS** SHUTTLEWORTH. .vol. iii. p. 17, pl. lxxvii. fig. 16.

*Helix Hopetonensis* SHUTTLEWORTH, Bern. Mitt. 1852, p. 198.

REEVE, Con. Icon. No. 709, (1852).

PFEIFFER, Mon. Hel. Viv. iii. 263.

CHEMNITZ, ed. ii. p. 420, pl. cxlviii. figs. 17, 18.

I have it also from Florida, and St. Simon's Isle, Georgia. (Postell.)

**HELIX VENTROSULA** PFEIFFER.

PLATE LXXVII. FIGURE 14.

*T. rimato-perforata*, depresso-globosa, tenuis, subtiliter striata, pellucida, corneo-albida; spira vix elevata; anfr. 5 vix convexiusculi, ultimus



superne subangulatus, subito deflexus, basi inflatus, antice gibbus et valde constrictus; apertura perobliqua, ringens; perist. acutum, latè reflexum, marginibus vix conniventibus, laminas elevatas in ventre anfractus penultimi angulatim junctas, emittentibus, dextro lamina subperpendiculari, dilatata, basali dentibus 2 acutis munito. [Pfr.]

## SYNONYMS AND REFERENCES.

*Helix ventrosula* PFEIFFER, Proc. Zool. Soc. 1845, p. 131; Mon. Hel. Viv. i. 417; iii. 266.

CHEMNITZ, ed. 2, i. p. 373, (1846,) pl. lxxv. figs. 5, 6, (1849).

REEVE, Con. Icon. No. 687, (1852).

## DESCRIPTION.

*Animal* not observed.

*Shell* minutely perforated, globosely depressed, thin and shining, pellucid, delicately striated, horn-colored; spire slightly raised, whorls 5 but little convex, the last one subangulated at the periphery, falling suddenly towards the aperture, inflated below, and strongly contracted; aperture very oblique, much complicated with teeth; peristome acute, broadly reflected, its terminations scarcely approaching each other, but joined by two white, elevated laminæ, which are placed at acute angles on the parietal wall; the basal termination is also furnished with two white acute denticles, while on the other is placed a white sub-perpendicular, extended lamina.

Greater diameter, 13; lesser, 11; height,  $7\frac{1}{2}$  millimetres.

*Geographical Distribution.* Texas and Mexico.

*Remarks.* This shell was unknown to Binney, and erroneously considered by Gould (p. 193) as a synonym of *H. Texasiana*. It is, however, a remarkably well characterized species. It may readily be distinguished by the globose under-surface, and the basin-shaped aperture, narrowed to scarcely more than a chink by the prominent, white teeth.

**HELIX AURICULATA** SAY.....vol. ii. p. 186, pl. xl. fig. 1.

*Polygyra auriculata* SAY, (Binney's ed.) p. 10.

*Helix auriculata* DEKAY, N. Y. Moll. p. 47, pl. iii. fig. 28.

CHEMNITZ, l. c. i. 371, (1846).

DESHAYES in Lam. 3d ed. iii. 308: in Fer. l. c. i. 76.

PFEIFFER, l. c. iii. 266.

REEVE, Con. Icon. No. 700, (1852).

It will appear from the above synonymy that I have separated *H. avara* from this species. Other species may also be included in *auriculata* Binney, but I make no inquiry concerning them, as my friend Mr. Bland will soon publish an elaborate article on this group.

Ferussac's (pl. 50, fig. 3) *var. minor* is quoted as a variety of *auriculata* by Pfeiffer, in the first volume of his great work, but in volume third is doubtfully referred to *uvulifera*.

I have specimens measuring 16 millimetres in diameter. They are from St. Augustine, Fla., the only locality, indeed, from which I have received the true *auriculata*, the smaller variety from the keys being probably *H. uvulifera*.

The shell is carried on the animal in a manner quite different from that of the other species, the axis being quite horizontal.

**HELIX AVARA** SAY.....vol. ii. p. 186, pl. xl. fig. 2.

*Polygyra avara* SAY, (Binney's ed.) p. 11.

*Helix avara* DEKAY, N. Y. Moll. p. 47.

CHEMNITZ, l. c. i. 370, (1846,) pl. lxxv. figs. 1, 2, (1849).

PFEIFFER, l. c. i. 418; iii. 267.

REEVE, l. c. No. 720.

DESHAYES in Fer. l. c. i. 78.

*Helix Sayii* DEKAY, l. c. p. 47.

I have already remarked that the confusion existing concerning this and the preceding species is about to be rectified by Mr. Bland. I will, therefore, refrain from making any remarks at this time.

The species as it now stands has been found from Georgia to Texas; in some of the intermediate States the individuals are extremely numerous.

Say's description is as follows.

**P. AVARA.** — Shell covered with numerous short, robust hairs ; spire convex ; whorls four, regularly rounded, with hardly elevated lines forming grooves, which are much more conspicuous near the mouth ; mouth subreniform, two projecting, obtuse teeth on the outer lip within, separated by a deep sinus ; outer lip elevated, equal, describing two-thirds of a circle ; pillar-lip elevated, broadly but not profoundly emarginate, concave beneath, and connected to the inner side by an elongated, lamelliform tooth, which is placed obliquely on the penultimate whorl, near the middle of the mouth ; lips almost equally prominent, continued ; umbilicus moderate, not exhibiting the volutions, no groove on the penultimate whorl within it.

Breadth quarter of an inch. Inhabits Florida. Cabinet of the Academy. Animal longer than the breadth of the shell, acute behind, above granulated and blackish, beneath, and each side, white.

This we found in the orange groves of Mr. Fatio, on the river St. John, East Florida ; it is usually covered with a black, earthy coat, which is probably retained and collected by the hairs. When unencumbered with this vesture, the shell is of a horn-color. It is by no means so common as the preceding species.

**HELIX UVULIFERA** SHUTTLEWORTH. .... vol. iii. p. 20.

*Helix uvulifera* SHUTTLEWORTH, Bern. Mitt. 1852, p. 199.

CHEMNITZ, ed. 2, ii. 420, pl. cxlviii. figs. 19, 20, (1853).

PFEIFFER, Mon. Hel. Viv. iii. 267.

*Helix florulifera* REEVE, Con. Icon. No. 699, (Aug. 1852).

*Helix auriculata* minor FERUSSAC, Hist. pl. l. fig. 3? (teste Pfeiffer).

This species is known in many American cabinets as a small variety of *auriculata*.

I have one specimen from Texas, received from Mr. Cuming.



**HELIX VULTUOSA** GOULD. .... vol. ii. p. 189, pl. xl. a, fig. 4.

*Helix vultuosa* CHEMNITZ, ed. 2, ii. 365, pl. cxxvii. figs. 10-12.

REEVE, Con. Icon. No. 711, (1852).

PFEIFFER, Mon. Hel. Viv. iii. 263.



**HELIX ARIADNÆ PFEIFFER.**

PLATE LXXVIII. FIGURES 1, 3, 4.

*T.* arcuato-rimata, depressa, subdiscoidea, solidula, diaphana, superne plicatula, albida; spira subplana; anfr. 5 suturâ impressâ distincti, planiusculi, ultimus antice subito deflexus, valdè constrictus, basi paulo convexior, sublævigatus; rima umbilicalis arcuata, in perforationem obliquam, punctiformem terminata; apertura parvula, perobliqua, lunato-circularis, ringens; perist. breviter reflexum, marginibus conniventibus, linguâ bieruci, profunde intrante, flexuosâ junctis, basali plicis 2 validis, marginalibus, intrantibus, approximatis, dextro plicâ profundâ margini parallêlâ munito. [Pfeiffer.]

## SYNONYMS AND REFERENCES.

*Helix Ariadnæ* PFEIFFER in Zeitsch. f. Mal. 1848, p. 120; Mon. Hel. Viv. iii. 266.

CHEMNITZ, ed. 2, i. p. 372, pl. lxxv. figs. 19-21, (1846).

*Helix Couchiana* LEA, Proc. Phila. Acad. 1857, p. 102.

## DESCRIPTION.

*Animal* not observed.

*Shell* with a rounded umbilical groove, terminating in a minute oblique perforation, depressed, subdiscoidal, nearly transparent, bluish white, with scarcely perceptible wrinkles on the upper surface; spire flattened; whorls five, separated by a distinct suture, flattened, the last one suddenly falling towards the aperture, very much contracted and pinched behind the peristome, more convex and smoother below; there is a deeply chiselled, rounded, umbilical groove as mentioned above, the umbilical region is also channelled; aperture small, extremely complicated with teeth, very oblique and circular; peristome white, slightly reflected, its terminations approaching each other and joined by two flexuose, elevated, acute laminae, converging to a point far within the aperture; the basal portion of the peristome is also furnished with two stout, entering, converging, marginal folds, while the right termination of the peristome has a more delicate, deeply seated, elongated lamina, running almost parallel with the peristome.



Greater diameter, 12; lesser, 10; height, 5 millimetres.

*Geographical Distribution.* Pfeiffer gives Central America as the habitat in Chemnitz, but in the Monographia he gives none. The shell figured (fig. 4) is from Tamaulipas, Mexico, where it was collected by Berlandier. I have seen no specimens found strictly within the limits of the Union, though we have every reason to expect to discover them in Texas.

*Remarks.* This can be confounded with no known American species. It is at once distinguished by the remarkable aperture, the flat spire, convex base, and umbilical channel. It is sufficiently transparent to allow the suture to be seen through the base of the shell, when held towards the light.

I have given the outlines of the figures in Chemnitz, as well as an enlarged view of the curious aperture.

The shell referred to doubtfully as a variety of *Helix Loisa* in my Notes p. 5, may be an immature specimen of *Ariadnæ*.

Mr. Lea's original specimen of *H. Couchiana* was obtained from the same source as the shell I have figured (fig. 4), and resembles it in every particular. I have not, therefore, the slightest hesitation in placing it in the synonymy of this species. His description is as follows:

T. supernè paulisper elevatâ, subplanulatâ, infernè subinflatâ; nitidâ, abidâ, longitudinaliter et subtiliter striatâ, minutè perforatâ; anfr. 5; aperturâ rotundatâ, quinquedentatâ; labro subacuto.

Hab. Texas — L. Berlandier, M. D.

#### HELIX HIPPOCREPIS PFEIFFER.

PLATE LXXVIII. FIGURE 19.

Testa angustè umbilicata, depressa, solidula, confertim arcuato-plicata, opaca, fuscula; spira vix elevata; anfr.  $5\frac{1}{2}$  angusti, vix convexiusculi, suturâ impressâ juncti, ultimus supernè carinatus, basi convexior, anticè solutus, subito deflexus, pone aperturam constrictus et gibboso-inflatus; umbilicus extus latiusculus, angustissimè pervius; apertura subhorizon-

talis, auriformis, ringens; perist. sublabiatum, marginibus callo elevato, angulari, supernè laminam profundè intrantem alteramque minorem prope columellam (ambas profundè ferri equino instar connexas) emitte-junctis, supero breviter expanso, laminam obliquam immittente, basali calloso-reflexo. [Pfeiffer.]

## SYNONYMS AND REFERENCES.

*Helix hippocrepis* PFEIFFER in Roëmer's Texas, p. 455; in Zeitsch. f. Mal. 1848, p. 119; Mon. Hel. Viv. iii. 267.

CHEMNITZ, ed. 2, ii. 333, pl. cxxxi. f. 4-6.

REEVE, Con. Icon. No. 1238, (1854).

## DESCRIPTION.

*Animal* not observed.

*Shell* perforated, depressed, rather heavy, closely striated, opaque, smoky; spire flattened; suture impressed; whorls  $5\frac{1}{2}$ , scarcely convex, the last carinated above, more convex below, falling abruptly at the aperture, and behind it very much contracted and with a prominent isolated bulge; umbilicus at first expanded and grooved, but rapidly terminating in a minute perforation; aperture almost horizontal, ear-shaped, complicated with teeth; peristome white, thickened, its extremities joined by an elevated, sharp, angular ridge, from which protrude far within the aperture two laminæ, (the upper one sharper and more prominent,) the connecting terminations of which within the shell resemble a horseshoe; the upper portion of the peristome is slightly reflected and furnished with an oblique entering angle, and the basal portion is callous and reflected.

Greater diameter, 12; lesser, 10; height, 5 millimetres.

*Geographical Distribution.* New Braunfels, Texas. (Roëmer.)

*Remarks.* The smaller, columellar lamina, from which the name of the shell is derived, is not represented in the plate.

This species is remarkably well characterized and cannot be compared or confounded with any other known American shell. It is very rare in cabinets.

**HELIX TEXASIANA** MORICAND. .... vol. ii. p. 191, pl. xlv. fig. 1.

*Helix Texasiana* PFEIFFER, Mon. Hel. Viv. i. 418; iii. 267, excl. syn. and var.  $\beta$ .

CHEMNITZ, ed. 2, (1846,) i. p. 85, excl. var. and figure.

DESHAYES in Lam. ed. 3, iii. 316.

REEVE, Con. Icon. No. 707.

DESHAYES in Fer. i. p. 74, pl. l. c. (excl. synonym.)

*Helix triodonta* FERUSSAC, Mus. Par.

*Helix Tamaulipasensis* LEA, Proc. A. N. S. Phila. 1857, p. 102.

Deshayes, also, in Ferussac's great work, confounds *fatigiata* with this. In Chemnitz, ed. 2, Pfeiffer makes the same errors of synonymy as in his Monograph. The figure is not this species, nor is it easy to determine what it is.

Shuttleworth, in his Diagnosen, has also pointed out Pfeiffer's error in placing *fatigiata* and *plicata* in the synonymy of this species.

From notes received from Pfeiffer, and also from memoranda taken by my father at the Garden of Plants, it appears that *triodonta* is identical with this species. On vol. i. p. 162, a different opinion is expressed on *triodonta*.

The variety of this species figured on pl. 78, fig. 18, was at first considered a distinct species by me. Having sent specimens to Pfeiffer, he writes that they are merely varieties. It is distinguished by a wider umbilicus, and a somewhat different arrangement of teeth.

There can be no doubt of the identity of *H. Tamaulipasensis* with *H. Texasiana*. I have based my opinion on a careful examination of Mr. Lea's shell. His description is as follows:

T. supernè paulisper elevata, subplanulata, infernè subinflata, nitida, longitudinaliter et subtiliter striata, minutè perforata, anfr. 5; apertura lunata, tridentata; labro spissato, reflexo. Texas.

Pfeiffer describes a var.  $\beta$ , a larger form with 6 whorls, horn-colored, and having a reddish band revolving above the periphery. I have received it from Dr. Moore of Texas.



*H. Texasiana* is also found in the neighboring Mexican State of Tamaulipas. Reeve gives Alabama as the habitat.

### HELIX MOOREANA.

PLATE LXXVIII. FIGURE 24.

Testa orbiculato-depressa, carinata, umbilicata, albida; spira obtusa, plus minusve elevata; anfr. 6, vix convexiusculi, striati, ultimus infra carinam non rotundatus; sutura impressa; subtus striæ minus distinctæ; anfr. 1½, ultimus carinâ valdè productâ anfr. alterum et umbilicum profundum pene tegens; apertura orbicularis, contracta, tridentata; perist. album, incrassatum, vix reflexiusculum, margine basali dentibus duobus curvatis marginalibus sinu parvulo orbiculari separatis, armato; plica alba rectangularis, dentiformis, excavata, in medio aperturæ projecta ad columellam adnata et perist. margines connectans.

#### SYNONYMS AND REFERENCES.

*Helix Mooreana* W. G. BINNEY, Proc. A. N. S. Phila. 1857, p. 184; Notes p. 4.

#### DESCRIPTION.

*Animal* not observed.

*Shell* orbicular, depressed, white, carinated, umbilicated; spire more or less depressed, obtusely rounded; whorls 6, distinctly striated, hardly convex; suture impressed; below the carina the body whorl is not rounded, but slants down to the base which is parallel with the suture; below, the striæ are less distinct; at the umbilical region only 1½ whorl is visible, the outer one strongly carinated so as to conceal a portion of the umbilicus and a great part of the remaining whorl; the umbilicus is very small, but perforates the shell to the apex, showing all the volutions with the aid of a lens; aperture rounded, contracted by three teeth; lip heavy, broad, white, hardly reflected, near the basal extremity, quite on the edge, armed with two short, incurving teeth, separated by a small, rounded sinus; on the columella there is a tooth-like fold, square, projecting across the aperture, its extremities joining those of the peristome.



Greater diameter  $8\frac{1}{2}$ , lesser 7, height 3 millimetres.

*Geographical Distribution.* Found in large numbers by Dr. Francis Moore in Washington Co., Texas.

• *Remarks.* It is difficult to express correctly in words the specific differences of the various *Polygyræ*. This shell combines the characteristics of several American species. It has the spire of *H. monodon* Rackett, and the columellar fold of *Dorfeuilliana* Lea, as figured Tr. Am. Phil. Soc. vi. pl. xxiv. f. 118. The teeth are placed on the inner edge of the peristome, as in *Texasiana* Mor., and the curious carination at the umbilical region resembles that of *pustula* Fer., which has not been noticed in descriptions.

### HELIX THOLUS.

PLATE LXXVIII. FIGURE 21.

Testa solidiuscula, albida, nitens, costis obliquis notata; spira rotundata, elevatiuscula, obtusa, tholiformis; sutura valdè impressa, anfr. 7, convexusculi, superi magis planulati, ultimus ad aperturam descendens, obtusè carinatus, carina peristoma non attingens, post perist. canaliculatus; infra carinam costæ minus distinctæ; basis plana, umbilicus latus, perspectivus, anfractus canaliculatos monstrans, quorum  $2\frac{1}{2}$  perspicuè, alii obscurè videntur; apertura perobliqua, semicircularis, ab axe remota; perist. album, latum, incrassatum, margine basali reflexiusculo, dentibus duobus sinu rotundato disjunctis armatum; plica parietalis acuta, in medio aperturæ projecta, margines peristomatis vix connectens.

#### SYNONYMS AND REFERENCES.

*Helix tholus* W. G. BINNEY, Proc. A. N. S. Phila. 1857, p. 186; Notes, p. 6.

#### DESCRIPTION.

*Animal* not observed.

*Shell* rather solid, white, shining, ribbed above, smoother below; spire obtuse, little elevated, rounded; whorls seven, convex, the upper ones more flattened, the last bluntly carinated; carina not reaching the peristome; base parallel to the suture; umbilicus broad, half the larger diameter of the shell, showing two and a half deeply grooved

whorls plainly, the others rapidly retreating towards the apex; aperture very oblique, semicircular, removed from the axis of the shell, bordered with a scarcely reflected, white, heavy rim, grooved behind, and armed with two stout teeth near the basal extremity, broadly reflected at the junction with the body whorl; on the parietal wall of the aperture is a white fold, hardly connecting the extremities of the lip, and projecting across the aperture into an acute point.

Greater diameter 11, lesser 9, height 4 millimetres.

*Geographical Distribution.* When describing this species I had seen but one specimen of it in the collection of Mr. Bland. It was supposed to inhabit Texas. Since that time another specimen has been received by him from an undoubted Texan locality.

*Remarks.* The aperture of this curious shell resembles that of *H. fatigiata* Say. It is readily distinguished from that and all other described species by the umbilicus, broad at the commencement, and rapidly narrowing beyond the second whorl, with the peculiar groove visible in all the whorls of the umbilicus, of the same character as that noticed by Say in *auriculata*, though deeper.

The name is derived from the resemblance of the slightly raised, rounded spire to a low dome.

**HELIX FATIGIATA** SAY.....vol. ii. p. 193 (pars), pl. xxxix. fig. 4.

*Helix fatigiata* (Polygyra) SAY, (Binney's ed.) p. 37.

BINNEY in Bost. Journ. l. c. ex parte, (excl. syn. et fig.)

SHUTTLEWORTH, Diag. n. Moll. ii.

BLAND, N. Y. Lyceum, vi. 283; Notes, 7.

*Helix Texasiana* var. B. CHEMNITZ, ed. 2. i. p. 86, excl. descr., syn. et fig.

DESHAYES in Fer. i. p. 74, excl. descr., syn. et fig.

*Helix Texasiana* β PFEIFFER, Mon. Hel. Viv. i. 418; iii. 267.

*Helix Dorfeuilliana* DESHAYES in Fer. i. 73 (excl. syn.) pl. 69 D, fig. 3.

*Helicina fatigiata* DEKAY, N. Y. Moll. p. 82.

The figure to which I have referred is a correct representation of the specimen of *H. fatigiata* deposited by Mr.

Say in the collection of the Philadelphia Academy. It represents the only form of the species, those included by Binney under the same name being referred more properly to the succeeding species. There is consequently much confusion in the synonymy, remarks, and geographical notes of this group. The true *H. fatigiata* is described by Shuttleworth (l. c.) and figured by Deshayes under a wrong name, as well as placed in the text of his work among the synonyms of *Texasiana*. Pfeiffer in both of his works considers it as a variety (*distinctius carinata*) of *Texasiana*, and in Malac. Blatt, 1856, p. 11, declares Shuttleworth's notes on it unsatisfactory. DeKay has placed it in the genus *Helicina*.

In the Boston Journal, Binney joins *pustula* to this species, though doubtfully. By his notes, taken at the Jardin des Plantes, it appears the species occurs there under the name of *operculata* Val.

Bland has corrected the errors of previous writers, and thus points out the distinguishing characteristics of the species.

*H. fatigiata* Say is larger than *Troostiana* Lea, *plicata* Say, and *Dorfeuilliana* Lea; it is most nearly allied to the first, and through it is connected with the second, but wholly distinct from the last. The parietal tooth is more rectangular than that of *Troostiana*, in which it is slightly emarginate near the tip,—but much more so in *plicata*, while the parietal tooth in *Dorfeuilliana* is rather quadrate. The teeth on the peristome in *fatigiata* and *Troostiana* are much alike, as regards form, size, and position,—the superior one being the largest,—both are larger and transverse in *Dorfeuilliana* and in *plicata*, the inferior one being the largest in the latter. Behind the peristome there are two small pits, showing the situation of the teeth in *fatigiata* and *Troostiana*, while there is scarcely more than a deep, well marked constriction in *Dorfeuilliana*. *H. Troostiana* has a slight groove on the inner side of the last whorl, the absence of which in *fatigiata* is noticed



by Say, but I scarcely consider that a good specific character. Fresh specimens of *H. fatigiata* are, I believe, covered with a very thin epidermis, on which hairs are sparingly scattered, — the scars of the hairs may be detected, especially on the last whorl, in denuded shells.

*H. fatigiata* has, at a short distance within the aperture on the base of the last whorl, a small, detached, erect, rounded tubercle, answering probably the same purpose in the economy of the animal, as the “fulcrum” originally noticed by Mr. Lea (Observations, Vol. V. p. 80) in *H. spinosa*, though of a different construction.

I do not think the true *fatigiata* inhabits Ohio. It seems more properly to belong to the region of Tennessee.

Pfeiffer's objection to the retention of the name, which is evidently a misprint, can hardly be removed, since the name *fastigiata* is already occupied by another species.

#### HELIX HAZARDI BLAND.

##### PLATE LXXVIII. FIGURE 13.

*Polygyra plicata* SAY, l. c.; (Binney's ed.) p. 21.

*Helix fatigiata* BINNEY, in Bost. Journ. l. c. (excl. syn. et fig.) in Terr. Moll. (excl. syn. et fig.)

*Helix Texasiana* PFEIFFER, l. c. (excl. syn. et descr.)

CHEMNITZ, (excl. syn., descr. et fig.)

*Helix Dorfeuilliana* DESHAYES, in Fer. l. c. (excl. descr., syn. et fig.)

*Helix Troostiana* W. G. BINNEY, Notes, p. 21.

*Helix Hazardi* BLAND, N. Y. Lyc. vi. 291; Notes 16, pl. ix. figs. 17-20.

*Helicina plicata* DEKAY, N. Y. Moll. p. 23.

There are Kentucky specimens of this shell deposited in the Philadelphia Academy by Say. His description is as follows: —

**POLYGYRA PLICATA.** Shell convex beneath, depressed above, spire slightly elevated; whorls five, compressed, crossed by numerous raised, equidistant lines, which form grooves between them; aperture subreniform, labrum reflected, regularly arcuated, describing two thirds of a circle; within two-toothed, teeth not separated by a remarkable sinus; labrum with a profound duplicature, which ter-



minates in an acute angle at the centre of the aperture; beneath exhibiting only two volutions, of which the external one is slightly grooved near the suture.

Inhabits Alabama. Breadth, one fourth of an inch. Cabinet of the Academy.

This species is about the same size as *P. avara*, but, besides other characters, it is sufficiently distinguished by the acute fold of the labrum. It was sent to the Academy by Mr. Samuel Hazard.

A more careful study has induced me to change my opinion of the identity of this species with *H. Troostiana*.

Bland is the only author who has correctly dealt with this species. His description is given below, while his figure is given on pl. 78, fig. 13. He proposed this name in place of Say's preoccupied one.

This shell may be distinguished from *fatigiata* Say, and *Troostiana* Lea, independently of the absence of the carina, by its smaller size, and more particularly by the different form, relative size, and position of the teeth. In those species the superior tooth on the peristome is transverse, compressed, and larger than the inferior one, from which it is separated by a "remarkable sinus," distinctly visible on looking into the aperture; the inferior tooth is obtuse. Immediately behind the peristome, the position of the teeth is marked by small shallow pits, giving the character to the last whorl designated by Shuttleworth "*scrobiculato-constrictus*,"—the striae run over the whorl up to the peristome. In *H. Hazardi*, the two teeth on the peristome are of the same character as the superior one in *fatigiata* and *Troostiana*,—the inferior tooth is however the largest, and so partially conceals the lower margin of the superior one as to obstruct the view into the aperture, and give no appearance of separation "by a remarkable sinus." Both the teeth are more deeply seated than in the other species. The nature of the scrobiculation behind the peristome in *H. Hazardi* alone sufficiently distinguishes it from its allies. The space behind the peristome, and between it and the curved pit, showing the seat of the superior tooth, is convex and smooth, the striae not extending over it.

This species has, in common with *fatigiata* Say and *Troostiana*

Lea, a thin, brown, but more sparingly hirsute epidermis. I have noticed the tubercle within the last whorl, near the aperture, in *fatigiata* and *Troostiana*, but no such process exists in the species now under consideration. In *H. Hazardi*, the inferior tooth of the labrum, at its inner end, is continued back within the aperture, forming a white erect lamella on the floor of the whorl, parallel with, and leaving a narrow sinus between it and the inner wall, to which it is joined at its extremity, about  $2\frac{1}{2}$  mill. from the edge of the peristome. The position of this lamella can be seen through the shell.

The species is also found among the Cumberland Mountains of Tennessee (Elliott).

Conrad, in the second volume (N. S.) of Silliman's Journal, speaks of finding *H. plicata* Say in Florida. He probably refers to some other species.

#### HELIX DORFEUILLIANA LEA.

PLATE LXXVIII. FIGURES 2, 14.

*Helix Dorfeuilliana* BLAND, ANN. N. Y. LYN. VI. P. 294; Notes, p. 18, pl. ix. figs. 24-26; nec PFEIFFER, DESHAYES, CHEMNITZ, REEVE.

*Helix fatigiata* BINNEY, BOST. JOURN. ET TERR. MOLL. I. C. (EXCL. DESCR., SYN. ET FIG.)

*Polygyra Dorfeuilliana* LEA, I. C.

TROSCHEL, AR. F. NAT. 1839, II. 222.

The figure 2 which I have given is a fac-simile of Lea's; his description is as follows:—

T. supernè obtusq-conicâ, infernè subinflatâ, nitidâ, corneâ, longitudinaliter striatâ, late umbilicatâ; anfr. 6; aperturâ lunatâ, tridentatâ.

Shell above obtusely conical, below somewhat inflated, shining, horn color; longitudinally striate, widely umbilicate; whorls six; aperture lunate, three toothed.

*Hab.* Ohio. Mr. Dorfeuille, Cincinnati.

Diam. .3; length .2 of an inch.

*Remarks.* I adopt Mr. Say's genus *Polygyra*, believing the division, though very artificial, quite as good as many made by Lamarck. This species has, like *P. fatigiata* Say and *P. plicata*

Say, one large tooth on the left lip, and two smaller ones on the right lip. It differs from the first in not being carinate, from the last in being larger, and having larger striæ. In the *Dorfeuilliana* the tooth on the left lip is large and square, with an indentation in the centre. The view into the mouth is nearly obstructed by the teeth, leaving, to appearance, three nearly square apertures. The superior part of the shell is striate, while the inferior part is nearly smooth, and exhibits two volutions. I have seen but a single specimen, which, I believe, is the only one obtained by Mr. Dorfeuille, who obligingly sent it to me.

Mr. J. G. Anthony obtained from Mr. Dorfeuille some facts concerning the original discovery of this species, which prove beyond all doubt that it was accidentally brought from Kentucky. It is not an inhabitant of Ohio.

The species has been confounded with several others by Reeve, Pfeiffer, Deshayes, and Binney. Bland was the first after Lea to correctly treat it. He thus describes its characteristics:—

*H. Dorfeuilliana* Lea differs materially in its characters from the three preceding species; the striæ on the upper surface are not so well defined as in *Troostiana*, but more so than in *Hazardi*, while the base is more smooth than in either of them, having only very delicate striæ, with microscopic impressed spiral lines.

The parietal tooth is quadrate,—the two teeth on the right lip are more nearly of the same size and form than in *fatigiata* and *Troostiana*. In this species the inferior tooth is transverse, and in some specimens broader than the superior one, but has a somewhat pointed apex,—both are very nearly equally deeply seated, but so far apart as to allow a view between them into the aperture, leaving, as Mr. Lea expresses it, “to appearance three nearly square apertures.” Say would have described the two teeth as “separated by a remarkable sinus.” The peristome of this is more thickened and less reflected than in the other species,—behind it is deeply constricted, without any appearance of pits showing the position of the teeth within.

*H. Dorfeuilliana* Lea varies in size,—the following are the measurements of my largest and smallest specimens:—

Diam. maj. 8, min. 7, alt.  $3\frac{1}{2}$  mill.

“ “  $6\frac{1}{2}$  “  $5\frac{1}{2}$  “ 3 “

With respect to the shell considered by Shuttleworth to be *H. Dorfeuilliana*, it will be seen from the figure (Pl. ix. fig. 26), which differs, as he says, from Lea's, that the superior tooth on the labrum is larger and more deeply seated than the inferior one, and that the latter, though more developed, is much of the same form as the inferior tooth in *fatigiata* and *Troostiana*. The parietal tooth partakes of the general character of that in Lea's type of *Dorfeuilliana*, but its lower and terminal margins project more perpendicularly from the parietal wall. The umbilical perforation is also larger, and the base of the shell is more smooth.

The following are the measurements of a large specimen:—

Diam. maj. 9, min. 8, alt. 4.

I am much inclined to consider this a distinct species, but remark upon it, as I believe it is more commonly found in cabinets under the name of *Dorfeuilliana*, than the shell described by Lea.

*H. Dorfeuilliana*, and also the shell last considered, have a tubercle within, very similar to that in *fatigiata* and *Troostiana*.

#### HELIX TROOSTIANA LEA.

PLATE XXXIX. FIGURE 2. PLATE LXXVIII. FIGURE 11.

*Polygyra Troostiana* LEA, l. c.

TROSCHER, Ar. f. Nat. 1839, iii. 222.

*Helix Troostiana* PFEIFFER, Mon. Hel. Viv. i. 419; iii. 267.

DESHAYES in Fer. i. 75, pl. 69 D. fig. 4. ?

CHEMNITZ, ed. 2, i. 376, pl. lxxv. figs. 21-24.

REEVE, Con. Icon. No. 706, (1852).

BLAND, N. Y. Lyc. vi. 288; Notes, 12, pl. ix. figs. 21-23.

*Helix fatigiata* BINNEY in B. Journ. l. c.; in Terr. Moll., ex parte, ii. 193, pl. xxxix. fig. 2.

*Helix plicata* SHUTTLEWORTH, Diag. n. Moll. p. 18, (1852).

W. G. BINNEY, Notes, 11.

A more careful examination of Lea's specimen has convinced me of its specific distinction from *plicata*. On pl. 18, fig. 11, is a fac-simile of Lea's figure, and his description follows.



T. supernè subplanatâ, infernè subinflâtâ, corneâ, longitudinaliter striatâ, late umbilicatâ; anfr. 6; aperturâ lunatâ, tridentata.

Shell above nearly flat, below somewhat inflated, horn color; longitudinally striate, widely umbilicate; whorls 6; aperture lunate, three-toothed.

*Habitat.* Tennessee. Prof. Troost.

Diam. .4, length .2 of an inch.

*Remarks.* This species strongly resembles *P. Dorfeuilliana*, here-in described, being nearly of the same size, and possessing most of its characters. It differs, however, in the large solid tooth on the left lip being more angular, and in the two teeth on the right lip being somewhat differently placed. In the striæ it differs much, these being larger, much better defined, and passing over the whorls. In the umbilicus it is wider, and shows more of the two whorls. This shell forms the fourth of a group, the form of the apertures of which is exceedingly alike, viz. *P. fatigiata* Say, *P. plicata* Say, and *P. Dorfeuilliana* Nob.

As appears in the synonymy, this species has been much more fortunate than its allies, having been correctly determined by most writers. Shuttleworth, however, erroneously refers it to *plicata*.

Bland thus remarks on it:—

Mr. Lea has kindly allowed me to examine his original specimen, which differs from mine only in having the parietal tooth somewhat more emarginate.

*H. Troostiana* is very closely allied to *H. fatigiata* Say, from which I separate it with some hesitation. In its fresh state it has a thin, sparingly hirsute epidermis. I have moreover two specimens in my cabinet, (both hirsute,) which are as acutely carinated as *fatigiata*, with the striæ as prominent below as above, — (in one more numerous,) but both having the parietal tooth of *Troostiana*.

I am not altogether satisfied with the validity of Shuttleworth's remark, that the superior tooth in *fatigiata* is larger and more conspicuous than in *Troostiana*.

This species has the same tubercle within the last whorl as *H. fatigiata*.

**HELIX CEREOLUS** MÜHLFELDT, vol. ii. p. 196, pl. xxxviii. pl. lxxvii. fig. 23.

*Helix cereolus* MÜHLFELDT, Berlin Mag. viii. (1816,) p. 41, pl. ii. fig. 18.

CHEMNITZ, ed. 2, i. 378 (1846), pl. lxvi. figs. 1-3, (1849).

PFEIFFER, l. c. iii. 262.

REEVE, Con. Icon. No. 698.

*Helix planorbula* CHENU, Illustr. pl. xii. fig. 3.

*Polygyra septemvolva* SAY, (Binney's ed.) p. 11.

Mühlfeldt's description was published in 1816, and not in 1818 as quoted by Pfeiffer and others. This gives to his name the priority over Say's. His figure is copied on pl. 77, fig. 23; his description is as follows:—

Testa orbiculari, umbilicata, utrinque planata, alba, oblique subcostata, marginata, unidentata.

Die scheibenrunde genahelte, beiderseits flache, weisse, zart schief geribbte Schale, hat eine gesäumte, einzählige Mündung.

Die im Durchmesser  $4\frac{1}{2}$  Linien, in der Höhe aber, kaum mehr als 1 Linie haltende, matt weisse, zarte, aus achte Windungen bestehende Schnecke, ist beiderseits flach, doch hebet sich auf der oberen Seite, die deutlich schief geribbt ist, der Wirbel etwas empor, wodurch der Nabel der unteren Fläche, die nur zart schief gestreift erscheint, um so tiefer wird. Die erste Windung ist auf ihrem Oberrande etwas gekielt, die Mündung rund herum gesäumt, und da, wo die innere Lippe umgeschlagen, und dem Bauch der ersten Windung angewachsen ist, mit einem aufstehenden weissen Zahne versehen, der jedoch unausgewachsenen Exemplaren fehlt.

Der Aufenthaltsort ist vermuthlich Westindien? weil bei einer von daher gekommenen Parthie von Conchylien, sich etliche Exemplare befunden haben.

An error of quoting *Helix polygyrata* Binney has crept into Pfeiffer, Reeve, &c. The shell was never designated by that name.

The two following species, possessed by Dr. Binney in large quantities, are confounded by him in the text. The true *cereolus* is the middle figure of the plate referred to. It admits, however, of considerable variety. The most prominent variation is that furnished with an elongated thread-like lamina winding along the wall of the inner whorl of the shell. It is usually visible through the outer

whorl, at a little distance behind the parietal tooth, (vol. iii. p. 32). This lamina does not, however, distinguish it from the allied species, *H. microdonta*. The variety is also characterized by a less expansive umbilicus. It occurs in vast numbers on the banks of Indian River, Florida.

I am indebted to Mr. O. M. Dorman for fresh specimens of the true *cereolus*, found by him near St. Augustine. I have not received the species from any state but Florida, though Pfeiffer gives Georgia also as its habitat.

Another variety is furnished with the alternating spots which distinguish *H. microdonta*.

#### HELIX MICRODONTA DESHAYES.

##### PLATE LXXVIII. FIGURE 23.

Testa discoidea, planulata, albo-grisea, flammulis obliquis fuscis sub-rubrescentibusve ornata; supernè spira depressissima, subtus profundè latèque in ambitu umbilicata, tenuissimè et regulariter striata; apertura obliqua, marginata, ovato-semilunari; labio dente obliquo minimo prædito. Diam. 10; alt. 4 mill. (Deshayes.)

##### SYNONYMS AND REFERENCES.

*Helix microdonta* DESHAYES, in Fer. Hist. i. p. 6, pl. lxxii. fig. 13.

CHEMNITZ, ed. 2, i. 380 (1846), pl. lxxvi. figs. 10-12, (1849).

PFEIFFER, Mon. Hel. Viv. i. 409; iii. 262.

REEVE, Con. Icon. No. 705 (1852); No. 1040 (1853), *unspotted* var.

*Helix plana* DUNKER, Phil. Icon. i. 3, p. 51, tab. iii. fig. 11.

This shell was known to Dr. Binney by the numerous specimens in his cabinet from Florida Keys. He did not, however, recognize it as distinct. It is readily known by the alternating blotches of white on the under surface of the whorls, its heavier shell, less numerous whorls, and the internal lamina described under *cereolus*. This lamina and the white blotches are almost universally present. Specimens are common in cabinets. I have it from Key Biscayne, and many other Florida keys. Pfeiffer quotes it from Bermuda and Texas, and Poey from Cuba. The figure is copied from that of Deshayes.

**HELIX VOLVOXIS** PARREYSS.

PLATE LXXVIII. FIGURE 17.

*T. umbilicata*, orbiculato-convexa, tenuis, rufo-cornea, pellucida, regulariter costulato-striata; spira brevissima, convexa; anf. 7 convexi, regulariter accrescentes, ultimus reliquis superne vix latior, angulatus, infra angulum inflatus, striatus, nitidus; umbilicus latus, regularis, anfractu ultimo latissimo reliquis regulariter decrescentibus; apertura majuscula, reniformis; perist. intus callosum, reflexum, marginibus callo brevi, triangulari dentiformi junctis. Diam. maj. 9, min. 8, alt. 4 mill. (Pfeiffer.)

## SYNONYMS AND REFERENCES.

*Helix volvox* PARREYSS in Pfeiffer Symb. iii. p. 80; Mon. Hel. Viv. i. p. 409; iii. p. 262.

CHEMNITZ, ed. 2, i. 379 (1846), pl. lxvi. figs. 4-6, (1849).

REEVE, Con. Icon. No. 1237, (1854).

*Polygyra septemvolva* BECK? abs. desc. teste Pfr.

This species is readily distinguished by its smoother surface, its uniform color, and its regular under surface, exhibiting fewer volutions than any of the other forms. I have not detected any internal lamina. It is also the smallest of the group. I have it from St. Simon's Isle, Georgia, (Postell,) and Jacksonville, Fla. (Dorman.) It occurs in immense numbers. The outside figures on pl. 38, and the upper line of pl. 39, are probably drawn from varieties of this species.

**HELIX HINDSI** PFEIFFER.....vol. iii. p. 17, pl. lxxviii. figs. 5, 6, 8.

*Helix Hinds* PFEIFFER, l. c. iii, 265.

REEVE, Con. Icon. No. 712, (1852).

I have added to an enlarged view of the aperture on pl. 78, outlines of Pfeiffer's figures in Chemnitz.

**HELIX LEPORINA** GOULD.....vol. ii. p. 199, pl. xl. a. fig. 1.

*Helix leporina* REEVE, Con. Icon. No. 722, (1852).

BLAND, N. Y. Lyc. vi. 348; Notes, 39.

*Helix pustula*  $\beta$  PFEIFFER, Mon. iii. 268.

This species reaches a much more northern limit than



would have been anticipated. It occurs in Illinois (Kennicott!) Indiana (Ingalls) — also at St. Simon's Isle, Ga. (Postell!) Savannah (Elliott!) and on the Cattahoochee River, Ga. (Neisler!)

From letters received from Dr. Pfeiffer, he seems to have reversed his opinion regarding the identity of this species and *H. pustula*.

"Within and near the aperture, there is what may be called the '*fulcrum*,' extending from the floor of the last to that of the penultimate whorl, and approaching in character to, but less strongly developed, than that in *H. monodon* Rack. The outer edge of this *fulcrum* is uneven, — in one of my specimens somewhat denticulated." (Bland.)

#### HELIX PUSTULOIDES BLAND.

PLATE XXXIX. FIGURE 3.

This is the *pustula* of the *Terrestrial Mollusks* (vol. ii. p. 201) and not of Ferussac. Bland's description is given below from the N. Y. Ann. vi. 350, Notes, 40.

The species has been detected at Darien, Ga. (Dr. S. W. Wilson,) Columbus, Ga. (Neisler.)

T. late et perspective umbilicatâ, planorboideâ, tenuiusculâ, rufo-vel pallide-corneâ, minute striatulâ; epidermide tenui, pilosiusculâ; spirâ vix elevatâ; anfr. 4-4½, convexiusculis, lente accrescentibus, ultimo superne ad peripheriam obtuse angulato, ad aperturam gibboso-constricto, subito deflexo, basi deviante; suturâ valde impressâ; umbilico lato, ⅓ diam. maj. æquante, omnes anfractus monstrante, præsertim penultimum; aperturâ obliquâ, lunato-circulari; dente erecto, obliquo, albo, lamelli-formi, in pariete aperturali munito, callo lineari subarcuato superne ad angulum aperturæ juncto; perist. reflexo, roseo, marginibus conniventibus, dentibus duobus sinu disjunctis instructo.

*H. pustuloides* is intermediate in size between *H. pustula* and *H. leporina*, — is less globose than the former, and more sparingly hirsute. It differs widely from both in the character of the umbilicus,

— the aperture is much like that of *pustula*, but more narrow than that of *leporina*. The inferior tooth on the peristome is more developed laterally than in *H. pustula*, — indeed it has a somewhat bifid appearance, in which respect it is more allied to *H. leporina*.

The *fulcrum* in *H. pustuloides* is of the same nature as that in *H. leporina*, but less developed, and with the outer edge entire.

As to the *station* of the species, I copy the following from one of his (Dr. Wilson's) interesting letters: —

“The place has an eastern exposure to the sea, high tides rising to the base of the low bluff where they exist. The growth of trees, which consists mostly of live oak and *Celtis occidentalis*, has never been cleared off; the *Palmetto serrulata* flourishes as an undergrowth. The soil is covered for a few inches in depth with oyster-shells thrown there by the Indians, and decayed leaves and fragments of branches are of course over all these, under which, and among the superficial oyster-shells, the *Helices* live. *H. pustula* is nowhere near, or at least a rigid search did not reveal any. *H. concava* (dead) occurs in small numbers. *H. inflecta* abundantly.”

**HELIX PUSTULA** FERUSSAC. . . . vol. ii. p. 201 (ex parte), pl. lxxvii. fig. 12.

T. orbiculato-depressâ, tenue striatâ, anguste umbilicatâ; umbilico obtuso; rufâ vel pallide corneâ; anfr. angustis, convexusculis, suturâ depressâ conjunctis, ultimo basi convexiore prope aperturam deflexo, coarctato; aperturâ angustâ, arcuatâ, obliquâ, albâ; marginibus reflexis, basi dente mediocri, linguiformi, conjunctis; labro bidentato, dentibus approximatis inæqualibus. (Deshayes.)

#### SYNONYMS AND REFERENCES.

*Helix pustula* DESHAYES in Fer. i. 78.

PFEIFFER, iii. 268, (excl.  $\beta$ ).

CHEMNITZ, i. 376, (1846).

REEVE, Con. Icon. No. 721, (1852).

BLAND, N. Y. Lyc. vi. 346; Notes, 36.

I have given a fac-simile of Ferussac's figure of this species, there being no correct one in the Mollusks. As already observed, the *pustula* of Binney is not Ferussac's; it is *pustuloides* Bland. It is readily distinguished by its

more contracted umbilicus, as well as the following characteristics noticed by Bland.

The groove within the umbilicus is a very marked feature in Ferussac's species, and though not referred to in the description, is distinctly shown in one of his figures; it is entirely wanting in *H. leporina*, and also in *pustuloides*. This groove is not only an external character, but its presence modifies the internal structure of the shell. On opening the base of the last whorl immediately behind the aperture, a strongly developed transverse tubercle is seen within, from which a strong ridge-like lamella runs round the umbilical opening, corresponding in extent with the groove. This tubercle, and the extension of it, are entirely disconnected by a sinus or channel from the floor of the penult whorl.

The hirsute character of this species is not alluded to by any author. The outer edge of the peristome in specimens from St. Augustine, is of a deep rose color.

The true *pustula* has been found at various localities in Georgia, at St. Augustine, Fla. (Dorman), and in Texas, (Moore, Roemer.)

**HELIX LABYRINTHICA** SAY.....vol. ii. p. 202, pl. xvii. fig. 3.

*Helix labyrinthica* SAY, (Binney's ed.) p. 10.

CHEMNITZ, l. c. i. 382, (1846).

PFEIFFER, l. c. iii. 262.

REEVE, Con. Icon. No. 728, (1852).

DEKAY, N. Y. Moll. 39, pl. iii. fig. 31.

DESHAYES, in Fer. i. 210.

I have specimens of *H. labyrinthica* from the Northwest, Canada, Florida, and Texas. Its range is probably not surpassed by that of any other species.

Lea is erroneously given as authority for the specific name in Adams's Genera of Recent Mollusca.

**HELIX LIGERA** SAY.....vol. ii. p. 204, pl. xxxv.

*Helix ligera* SAY, (Binney's ed.) p. 19.

DEKAY, N. Y. Moll. p. 40, excl. fig.

CHEMNITZ, i. 208, (1846).

PFEIFFER, iii. 49.

DESHAYES in Fer. i. 184.

REEVE, Con. Icon. No. 493, (1852).

*Helix Rafinesquea* PFEIFFER, Symb. i. 39, (1841).

*Helix Wardiana* TROSCHEL, Ar. f. Nat. 1839, ii. 221.

DEKAY, N. Y. Moll. p. 46.

*Helix Rafinesquea* Ferussac may be *H. gularis*, as it is included among the group of that species in the *Tableaux Systematiques*. Deshayes, however, in the continuation of the *Histoire* refers it to *ligera*, as does Pfeiffer in his later works.

DeKay's figure is too little characteristic to be referred with certainty to any species.

*H. Wardiana* is universally acknowledged as a variety of this species.

Found also in Pennsylvania (Conrad!) and Kentucky (Kennicott!)

**HELIX INTERTEXTA** BINNEY.....vol. ii. p. 206, pl. xxxvi.

*Helix intertexta* DEKAY, N. Y. Moll. p. 38, pl. iii. fig. 29.

CHEMNITZ, i. 208, (1846).

PFEIFFER, l. c. iii. 49.

REEVE, Con. Icon. No. 668, (1852).

There is a strongly carinated, depressed form, occurring at the South, which forms a prominent variety.

The specimen figured is unusually large.

It is also found in Indiana, New York, Virginia, Kentucky, Tennessee, and Georgia. It also occurs fossil in the Postpleiocene of the West.

**HELIX SOLITARIA** SAY.....vol. ii. p. 208, pl. xxiv.

*Helix solitaria* SAY, (Binney's ed.) p. 19.

DEKAY, N. Y. Moll. p. 43, pl. iii. fig. 41.

CHEMNITZ, i. 180, (1846).

PFEIFFER, iii. 98.

REEVE, Con. Icon. No. 662, (1852).

The smaller variety mentioned in my Notes, p. 27, may,



perhaps, be referred to the following species. It was found at Fort Bridger.

Say's type is still preserved in the Academy at Philadelphia.

The species occurs in the Postpleiocene. It is doubtful whether it will ever be found in New York as DeKay anticipates.

### HELIX COOPERI.

PLATE LXXVII. FIGURE 11.

Testa umbilicata; elevato-globosa: solida; striis obliquis incrementi et lineis spiralibus leviter intercidentibus notata; alba, ad peripheriam fasciâ unicâ, angustâ, rufâ, cincta, aut fasciis et lineis rufis, volventibus, variê dispositis, ornata; sutura impressa; spira elevata; anfr. 5 convexi, ultimus rotundatus, ad aperturam valde descendens; umbilicus mediocris, pervius, 1-5 diam. maj. testæ æquans; apertura perobliqua, circularis; perist. simplex, incrassatum, ad umbilicum reflexiusculum, marginibus valde approximatis, callo albo, crasso, conjunctis.

#### SYNONYMS AND REFERENCES.

*Helix Cooperi* W. G. BINNEY, Proc. Acad. Nat. Sc. Phila. 1858, p. 118; Notes, p. 16.

#### DESCRIPTION.

*Animal* not observed.

*Shell* umbilicated; elevated, globose; solid, with oblique incremental striæ intersected with delicate spiral lines; color white, variously marked with a single narrow band, or broader longitudinal and spiral patches of reddish-brown; suture impressed; spire elevated; whorls five, convex, the last rounded, very decidedly deflected at the aperture; umbilicus moderate, pervious, 1-5th the greater diameter of the shell; aperture very oblique, circular; perist. simple, thickened, reflected at the umbilicus, with its extremities very nearly approached, and joined by a heavy white callus.

Greater diameter, 15; lesser, 13; height, 9 millimetres.

*Geographical Distribution.* Found by Dr. F. V. Hayden

(Yellowstone Riv. Ex. Ex.) in considerable quantities among the Black Hills of Nebraska Territory.

*Remarks.* The shells collected were weather-worn, but sufficiently fresh to show considerable variety in the disposition of the bands and revolving patches of coloring.

Resembles nearly no described American species. Has an elevated spire like *H. Pennsylvanica* Green, and somewhat approaches *H. solitaria* Say. It is, however, very much smaller, has rougher striæ and revolving lines; the umbilicus is different, as is also the circular aperture, with nearly approaching ends like *H. vittata* Mull., of Ceylon. There is a curious variety of *H. solitaria* Say, found by Lieut. Bryan at Bridger's Pass, which may be compared with this in size; but the only specimen I have examined has no revolving lines, and wants the characteristic aperture. Some specimens of this species have a more flattened spire.

Named in honor of Dr. J. G. Cooper, of P. R. R. Survey.

**HELIX ALTERNATA** SAY.....vol. ii. p. 212, pl. xxv.

*Helix alternata* SAY, (Binney's ed.) pp. 6, 21, pl. 69, fig. 2.

DEKAY, N. Y. Moll. l. c. non *scabra*.

PFEIFFER, iii. 98.

DESHAYES, in Fer. i. 89.

CHEMNITZ, i. 181.

REEVE, Con. Icon. No. 670, (1852).

BILLINGS, 1857, Canad. Nat. 2, 99, figs. 4, 5.

*Helix scabra* CHENU, Illust. tab. vi. fig. 11.

*Helix infecta* PFEIFFER, Mal. Bl. 1857, p. 86 — non REEVE.

*Helix strongylodes?* PFEIFFER, Proc. Zoöl. Soc. 1854, p. 53.

REEVE, Con. Icon. No. 1296, (1854).

I have specimens of this species collected from Canada to Texas, and most of the intervening States. I do not know of its existence in Florida. It is found plentifully in the Postpleiocene of Natchez Bluff, still retaining its color.

*Helix mordax* Shuttleworth will, I think, prove a variety of this species. *H. strongylodes* is also a variety, to judge from the figure I have given, (pl. 77, fig. 8,) drawn by Mr.

Sowerby from the type in the Cumingian collection. In regard to *H. infecta*, I cannot find specific characters in the specimen kindly sent me by Dr. Pfeiffer. The original descriptions of these two forms now follow:—

**HELIX INFECTA.** T. umbilicata, conoideo-depressa, tenuiter costulato-striata, corusco-albida, rufo obsolete fasciata et radiata; spira conoidea, vertice subtili; anfr. 6 convexiusculi, lente accrescentes, ultimus antice non descendens, peripheria obsoletissime angulatus; umbilicus conicus,  $\frac{2}{7}$  diametri subæquans; apertura diagonalis, lunato rotundata; perist. simplex, rectum, marginibus convergentibus, columellari subpatulo. Diam. maj. 17; min. 15; alt. 9 mill. Hab. in Canada teste Parreyss.

**H. STRONGYLODES.** H. t. umbilicata, convexo-depressa, solidula, oblique costulata, albida, maculis rufis superne variegata; spira parum elevata, obtusa; anfr. 6, sensim accrescentibus, primis isculis planu, sequentibus convexis, ad suturam tumidis, ultimo non descendente, terete; umb. perspectivus,  $\frac{1}{2}$  diametri æquante; apertura diagonali, lunato-rotundata; perist. simplice, recto, — marginibus subconvergentibus, columellari superne fornicatim patente. Diam. maj. 19; min. 16½; alt. 8½ mill. Hab. Texas.

**HELIX MORDAX** SHUTTLEWORTH.....vol. iii. p. 19.

*Helix mordax* PFEIFFER, Mon. Hel. Viv. iii. 635.

I have already expressed my belief that this is a mere variety of *alternata*. Pfeiffer (l. c.) merely repeats the original description, not having seen the shell.

**HELIX CUMBERLANDIANA** LEA.....vol. ii. p. 216, pl. xxxi.

*Carocolla Cumberlandiana* TROSCHER, Ar. f. Nat. 1843, ii. 124.

*Helix Cumberlandiana* PFEIFFER, iii. 114.

REEVE, Con. Icon. No. 701, (1852).

**HELIX STRIATELLA** ANTHONY.....vol. ii. p. 217, pl. xxx. fig. 2.

*Helix striatella* CHEMNITZ, ii. 115.

PFEIFFER, iii. 100.

REEVE, Con. Icon. No. 727, (1853).

*Helix rudrata* ADAMS in Sill. Journ. 40, p. 408.

Pfeiffer refers to this species the figure of Ferussac (t. 79, fig. 7) referred to *perspectiva* by Binney.

The species has been found also in Kansas, Wisconsin, and the District of Columbia.

**HELIX LIMATULA** BINNEY.....vol. ii. p. 219, pl. xxx. fig. 2.

Has also been detected in Michigan.

**HELIX MINUTISSIMA** LEA.

PLATE LXXVII. FIGURES 6, 7.

SYNONYMS AND REFERENCES.

*Helix minutissima* LEA, Trans. ditto, vol. ix. p. 17.

TROSCHER, Ar. f. Nat. 1843, ii. 124.

PFEIFFER, Mon. Hel. Viv. i. 87; iii. 83.

*Helix minuscula* teste BINNEY, vol. ii. p. 221.

ANTHONY, Ohio Cat. Jan. 1843.

There is every reason for reversing the decision of the identity of this and *minuscula*, expressed by Binney and Anthony. Lea's original specimen is figured in the plate from 'a drawing by Dr. Leidy. I give Lea's description below. The shell is readily distinguished from *minuscula* by its smaller size, less expanded umbilicus, minute striæ, and its greater resemblance in outline to *H. chersina*. Lea's specimen came from Ohio. It has been sent me from Greenwich, N. Y., by Dr. Ingalls.

Though considered in the *Terrestrial Mollusks* as a variety only of *minuscula*, I find a note taken by my father at Mr. Lea's collection, in which he says it is *not* the same.

This is our smallest shell, being one-fourth less in diam. than *H. exigua* St. The umbilicus is wide, and shows some of the interior volutions — though not so expanded as *H. minuscula* or *exigua*. The apex is distinctly and readily seen in the two last, and the suture is very much more impressed. *H. minutissima* has delicate striæ, but no ribs. The spire is variable in height.

**HELIX MINUTISSIMA** Lea. T. subglobosâ, supra obtuso-conoideâ, subtus convexa, fusco-cornea, minutissimè striata, umbilicatâ; suturis impressis; anfr. 4, rotundatis; apertura subrotundata, lab. acuto. Cincinnati.

Diam. .06, length, .04. It is the smallest species of our country which has come under my notice. Its very minute longitudinal striæ can only



be observed by a powerful lens. The umbilicus is rather large and deep. It is nearly the form of *H. labyrinthica* Say, but is a smaller species, is differently striated, and has no teeth. Found on wet sticks on the margin of a pond.

#### HELIX MILIUM MORSE.

The shell figured on plate 79, figs. 4 and 5, from a drawing of Mr. E. S. Morse, was sent me from Portland by that gentleman under this name. To publish it here would be anticipating his own description.

Since writing the above the description of this species has been published. It is given below, although it appeared after January 1st, 1859, the date to which the subject is brought down.

It is taken from the Proc. of Boston Soc. Nat. Hist. vii. p. 28, April, 1859.

Shell minute, transparent, shining; epidermis white, with a greenish tinge; distinctly and regularly striated above; whorls rounded, rapidly enlarging; suture very deeply impressed; spire slightly elevated; microscopic lines running parallel with the whorls, more conspicuous beneath; umbilicus quite large, deep, and showing all the volutions; outer lip sharp. Diam. 0.05; height, 0.02.

*Distribution.* Portland, Me.; Augusta, Me.; Bethel, Me.; Saco, Me.; Westbrook, Me.

*Observations.* The rapidly enlarging whorls remind one at first sight of the young of *H. indentata* Say. The under side resembles slightly the young of *H. minuscula* Binney. It is about the size of *H. minutissima* Lea.

The peculiarities of the shell are its diminutive size, its rapidly enlarging and well rounded whorls, its deep and regular striations, which become obscure at the apex, and the microscopic lines running parallel with the whorls.

This little shell I first found at Mt. Independence, Westbrook, Me., August 16, 1857, in company with *Pupa exigua* Say, and the smaller *Helices*.

Found generally on low lands, where they seemed to be sur-

rounded with water, though it has been found on high lands where the ground was comparatively dry. Mr. Charles B. Fuller, of Portland, found them quite numerous in a grove of pines, an unusual place for *Helices* to be found in.

**HELIX EXIGUA** STIMPSON.....vol. iii. p. 16, pl. lxxvii. fig. 19.

*Helix exigua* PFEIFFER, Mon. Hel. Viv. iii. 102.

*Helix annulata* CASE in Sill. Journ. May, 1847, vol. iii. p. 101; Ann. and Mag. Nat. Hist. 1847, p. 338.

PFEIFFER, l. c.

*Helix striatella* junior, GOULD, Sill. Journ. l. c. 276.

I also have specimens of this shell from Canada.

As suggested by Stimpson, (Shells of N. E. p. 55,) *H. exigua* is identical with *annulata* Case, which name, being preoccupied, will not stand. Gould, l. c., declares *annulata* to be the young of *striatella*, — an opinion he seems to have withdrawn by including Stimpson's description in vol. iii. He was at first rather inclined to refer the species to *costata* (vid. note to Case's description, l. c.)

I have given a fac-simile of one of Case's figures, which are characteristic, though rough. His description is given below. Pfeiffer copies both descriptions, not having seen either of the shells.

Shell minute, much depressed; umbilicus showing all the volutions; aperture simple and somewhat oval; whorls four, banded by sharp parallel ribs, inclining slightly forward; intercostal space marked with waved lines, running parallel with the whorls; nearly transparent; diam. about one line.

This minute but beautiful shell was found by Dr. B. A. Stanard, in the region about Lake Superior, and I have heard of its being observed in other places, but so far as I can learn it is undescribed. It differs from any description of the *pulchella* I have yet met with, in having uniformly an oval aperture and simple lip. The *minuta* of Say I believe never has the parallel ribs, and is supplied with a lip.

**HELIX MINUSCULA** BINNEY.....vol. ii. p. 221, pl. xvii. a. fig. 2.

*Helix minuscula* PFEIFFER, iii. 90.

CHEMNTZ, ii. 112.

REEVE, Con. Icon. No. 731, (1852).

*Helix minutalis* MORELET nec. Fer. Test. Nov. ii. p. 7.

*Helix apex* ADAMS, Contr. Conch. p. 36.

REEVE, l. c. 339.

*Helix Lavelleana* Orb. Moll. Cub. in textu, p. 161, excl. tab. (1853).

*Helix Mauriniana* Orb. l. c. in tab. viii. figs. 20-22, excl. textu.

Has been detected also in Michigan, Georgia, New York, and in Washington Co. Texas (Moore). Is also found in Cuba, Porto Rico, and Jamaica.

In Mal. Blatt. ii. 93, Pfeiffer states that *H. Lavelleana* is represented in the British Museum by poor specimens of *minuscula*. I follow the same author in placing *minutalis* and *apex* in the synonymy.

They are thus described.

*Helix apex*. Shell discoidal; whitish; with microscopic spiral striæ; spire scarcely elevated, convex; apex very obtuse; whorls 4, cylindrical, with a deep suture; aperture nearly circular; lip thin and sharp; umbilicus very wide.

*Helix minutalis*. T. perspective umbilicata, subdiscoidea, minute striatula, corneo-albicans; anfr. 4 convexiusculi, sutura impressa distincti; apertura vix obliqua, subcircularis; peristoma simplex, marginibus approximatis.

Hab. circa pagum Palizada provinciæ Yucatenensis, necnon in insula Cubana.

#### HELIX ASTERISCUS MORSE.

PLATE LXXVII. FIGURE 9.

#### SYNONYMS AND REFERENCES.

*Helix asteriscus* MORSE, Proc. Bost. Soc. Nat. Hist., vi. p. 128, March, 1857.

*Animal* short, bluish.

*Shell* small, orbicular, very much depressed; whorls four, rounded above and below; banded by twenty-five to thirty very thin, transparent, and prominent ribs, very oblique, inclined backward; spire not rising above the last whorl; suture deeply impressed; umbilicus moderately large, showing all the volutions; finely striated between the ribs; in some specimens parallel lines may be observed. Color light brown.

Dimensions: breadth,  $\frac{1}{16}$  in.; height,  $\frac{1}{32}$  in.

Found at Bethel, Me., in company with *Pupa pentodon* and *Pupa exigua*, September 28, 1856.

*Observations.* This shell differs from *H. annulata* Case, in being smaller, the umbilicus not so large, spire not elevated, intercostal space not marked with parallel lines, but finely striated; the color is also different.

Its peculiar thin, transparent ribs, depressed spire, and deep umbilicus, are prominent features that can never confound it with other species.

The above is Morse's description from the Proceedings of the Boston Society of Natural History, March, 1857, vol. vi. p. 128.

The figure is very much enlarged from a specimen kindly sent me by the discoverer. The species is very distinct, and cannot readily be confounded with any other now known to inhabit America. Another character which easily distinguishes it from the nearest allied species, *H. exigua*, is this: the ribs are much less numerous and seem formed by a continuation or lapping over of the epidermis at every period of repose from growth of the shell.

It is difficult to imagine on what grounds Gould could have based the opinion copied below from the Boston Proc. vi. 72.

This species, the most minute of any yet observed, was found by Mr. Morse in the vicinity of Portland, and has been collected also at several localities in Massachusetts. Dr. Gould considered it to be the species described by Mr. Lea, under the name of *Helix minutissima*. It was regarded by Dr. Binney as the young of *H. minuscula*, but Dr. Gould believed it to be a distinct species.

#### HELIX KOPNODES.

PLATE LXXX. FIGURE 14.

Testa depresso-globosa, corrugata, subtus lævigata; spira brevis, depressa; sutura mediocris; anfr. quinque, rapidè accrescentes, ultimus permagnus, ventricosus, interdum lineis volventibus crassis notata; apertura magna, rotundata; perist. simplex, acutum, marginibus approximatis,



callo levi, brunneo conjunctis, ad umbilicum parvum et profundum reflexiusculum.

## SYNONYMS AND REFERENCES.

*Helix kopnodes* W. G. BINNEY, Proc. Acad. Nat. Sc. Phila. 1857, p. 186; Notes, 6.

## DESCRIPTION.

*Animal* not observed.

*Shell* depressed globose, wrinkled, below smooth; spire short, depressed; suture moderate; whorls five, rapidly increasing, the last very ventricose and large, sometimes marked with coarse revolving lines; aperture large, round, lip simple, acute, ends approached, joined by a slight deposition of brownish callus over the parietal wall, reflected at the small and deep umbilicus.

Greater diameter, 35; lesser, 28; height, 13 millimetres.

*Geographical Distribution.* Found in Alabama in considerable quantity by C. S. Hale, Esq., and Dr. E. R. Showalter.

*Remarks.* I was at first inclined to consider it an unnaturally developed form of *fuliginosa*, but have since been convinced of its being distinct by large suites of various stages of growth. The color is lighter, the shell larger, heavier, less globose; the umbilicus is narrower; the aperture larger, and less rounded; the spire less elevated. The heavy, interrupted revolving lines are present in four out of six specimens before me.

Reeve's figure 672 has some resemblance to it in shape, though less globose, and described as striate.

**HELIX FULIGINOSA** BINNEY.....vol. ii. p. 222, pl. xxxi.

*Helix fuliginosa* CHEMNITZ, ii. 104.

PFEIFFER, iii. 83.

REEVE, Con. Icon. No. 675, (1852). ?

This can hardly be the species designated by Ferussac as *H. lævigata*. His figure and the opinion of Deshayes,

in his continuation of the *Histoire*, are both opposed to this theory. Rafinesque, it must be remembered, is responsible for the application of the name *lævigata* to a striated shell. He makes, however, greater errors than this.

If Rafinesque notices *fuliginosa* at all, it is in the Enumeration, &c. &c. p. 3.

*Omphalina*—Differs from *Helix* by no lips, but an ombalic.

*O. cuprea*. Suboval, four spires, smooth, brittle, diaphanous coppery, shining, opening very large. In Kentucky.

Griffith writes to Binney that *lucubrata* is the same as *fuliginosa*. Adams, l. c., gives the same opinion, as does also Anthony in his Ohio Catalogue. Notwithstanding the opinion of these authors, I am inclined to believe that neither *lucubrata* nor *lævigata* have any connection with *fuliginosa*. From letters of Say, in the possession of Mr. Bland, it appears he was unacquainted with *fuliginosa*. As regards *lucubrata* it is a Mexican species. If known to us at all, it is by Pfeiffer's redescription of it under the name of *caduca*. Specimens of this last agree perfectly with Mexican specimens of *lucubrata* preserved for many years in the Philadelphia Academy. It is, however, at present impossible to decide whether *lucubrata* has been met with since Say found it in Mexico, (see Binney's ed. p. 36).

### HELIX FRIABILIS.

#### PLATE LXXX. FIGURE 2.

Testa globosa, papyracea, friabilis, subdiaphana, nitens, rufescens; spira parvula, elevato-conica; anfr. quatuor, læviter corrugati, convexi, ultimus permagnus, ventricosissimus; sutura mediocris; apertura circularis, parum alta et longa, intus livida, callo levi, albo sub-incrassata; perist. acutum, tenue, simplex, ad basin reflexiusculum, violaceum, umbilicium parvum et profundum aliquantum tegens.

#### SYNONYMS AND REFERENCES.

*Helix friabilis* W. G. BINNEY, Proc. Acad. Nat. Sc. Phila. 1857, p. 187; Notes, p. 7.

## DESCRIPTION.

*Animal* not observed.

*Shell* very globose, transparent, brittle, thin, shining, reddish; spire very short, conic; whorls four, convex, lightly wrinkled, rapidly increasing, the last very large and ventricose; suture moderate; aperture circular, equally high and broad, within bluish and slightly thickened by a very thin white callus; perist. simple, sharp, thin, at its junction with the body whorl, violet-colored and reflected, so as to cover a portion of the small and deep umbilicus; the parietal wall of the aperture is covered with a light violet-colored callus.

Greater diameter, 26; lesser, 20; height, 13 millimetres.

*Geographical Distribution.* Found by Mrs. Say on the banks of the Wabash, Indiana, and in Illinois by Kennicott. Occurs also in Alabama (Showalter), and Texas, (Moore).

*Remarks.* Belongs to the same group as *H. fuliginosa* Binney — but readily distinguished from that and all described species by its transparent, globular shell, ventricose body whorl, and circular aperture. At the localities where it was found it seems to take the place of *H. fuliginosa*, as that species does not occur with it.

The specimen figured was found by Mrs. Say, as stated above. From Texas the specimens are much heavier.

**HELIX CADUCA PFEIFFER.**

This species was originally described from Mexico, but is catalogued by Röemer (Texas, 455) as found at New Washington. The species is nearly allied, if not identical, with *lucubrata* Say, as already observed in the remarks on *H. fuliginosa*. Pfeiffer's description is given below.

T. umbilicata, depressa, fragilis, breviter striatula, albida, epiderme fulvo-corneâ induta; spira parum elevata, vertice subtili; anfr. 5½ convexiusculi, ultimus multo latior, basi subplanulatus, circa umbilicum

latum angustum, externe subinfundibuliformem excavatus; apertura majuscula, oblique truncato-ovalis; perist. simplex, tenue, marginibus subconniventibus, callo tenuissimo junctis, columellari vix expansiusculo. Diam. maj. 27, min. 22, alt. 14 mill.

**HELIX LÆVIGATA** PFEIFFER.....vol. ii. p. 225, pl. xxxii.

*Helix levigata* PFEIFFER, Mon. Hel. Viv. i. 64; iii. 67, (excl. syn.)

CHEMNITZ, ed. 2, ii. 106, pl. 84, figs. 17-19, (excl. syn.)

REEVE, Con. Icon. No. 672, (1852). ?

DESHAYES in Fer. i. 94.

*Helix lucubrata* BINNEY, l. c. nec. SAY.

*Helix fuliginosa* BINNEY in B. J. (pars., excl. desc., syn., et fig.)

*Helix inornata* REEVE, l. c. 666.

I have given the synonymy of this species in full to show under how many names it has appeared. It appears to have been sent to Ferussac by Rafinesque under the name it bears, though no description of it by that author is extant. Ferussac mentions it by name only in his Tableaux (1821), with no reference, however, to the figure which afterwards appeared (1832) in the Histoire. In 1840, Binney evidently refers to it in the Boston Journal as a striated variety of *fuliginosa* and quotes Ferussac's figure. He also suggests its identity with *lucubrata*. In 1848 the first description of the shell was published by Pfeiffer, whom I have given as the authority for the specific name. In continuing Ferussac's great work, Deshayes also describes the shell, as does also Pfeiffer in the second edition of Chemnitz. It was therefore well established and universally known by the name of *lævigata* when the Terrestrial Mollusks appeared. The name proposed by Binney would not, therefore, have precedence over Pfeiffer's, even had it been an entirely new name. Binney, however, commits the error of applying to this species Say's name of *lucubrata*, though there is no evidence of Say's ever having seen the species. On the other hand, in Mr. Poulson's collection are specimens of *lævigata* labelled by Say "Helix ——— Claiborne, Ala."



The label written during the last few years of Say's life shows conclusively his ignorance of the species.

Pfeiffer, Deshayes, Chemnitz, and Reeve have confounded *H. inornata* with this species, even quoting in some instances Binney's figure of *inornata* in the Boston Journal, which represents an entirely smooth shell. Pfeiffer also quotes *H. rufa* DeKay as a synonym of *lævigata*. It seems rather to be the young of some other species.

Reeve figured *lævigata* under the name of *inornata*, describing it as striate in the text.

Much confusion regarding the species of this group has existed also among American collectors, who have depended for the names of their shells on their friends rather than on descriptions.

The species under consideration is at once distinguished from all the others of the group by the fact of its being the only one furnished with striæ on the upper surface.

It has also been found in Illinois, Indiana, Kentucky, Arkansas, North Carolina, and Florida.

Pfeiffer mentions a large variety from Florida. Reeve's fig. 672 may perhaps represent it.

For the views of Bland see the remarks on the following species.

**HELIX INORNATA** SAY.....vol. ii. p. 227, pl. xxxiv.

*Helix inornata* SAY (Binney's ed.) p. 24.

*Helix glaphyra* ? PFEIFFER, Symb. ii. 29, (excl. *H. fuliginosa*); Mon. i. 57; nec.  
REEVE, BLAND.

This species has been described and figured in America for many years, and is now well understood in American collections. During the last year it has been referred to *lævigata* by Bland, (N. Y. Lyc. vi. 352). In the remarks under *cellaria* his views will be given.

Pfeiffer gives Say's description, not having seen any authentic specimen. The shell described by him as *glaph-*

*gra* is evidently *inornata*. From his letters, it appears he will follow Binney's decision regarding *inornata* in the fourth volume of his Monograph.

Reeve figures and describes *inornata* under the name of *glaphyra*, misquoting Gould's opinion about the introduction of quite another shell. His *inornata* is the true *lævigata*.

Lewis (Bost. Proc. vi. 3) catalogues *inornata* under the name of *lucubrata*. My opinion is formed from an inspection of his specimen.

The species has also been found in the mountains of Virginia.

An anonymous writer (Sill. Journ. 31, p. 36,) suggests that *fuliginosa*, *glaphyra*, and *inornata* are but different stages of growth of the same shell.

**HELIX SUBPLANA** BINNEY.....vol. ii. p. 229, pl. xxxiii.

Found also in Pennsylvania. Pfeiffer suggests its identity with his *glaphyra*, (the true *inornata*). He had seen no specimen.

### **HELIX SCULPTILIS** BLAND.

PLATE LXXVII. FIGURE 15.

T. obtecte perforatâ, suborbiculari, depressâ, subpellucidâ, pallide cornâ, nitenti, lineis transversis regularibus concinne impressâ; spirâ parum elevatâ, subconvexâ; anfr. 7, planulatis, ultimo rapide accrescente, prope aperturam  $\frac{1}{2}$  diam. subæquanti; basi planulatâ, leviter excavatâ; suturâ parum impressâ; aperturâ subobliquâ, depressâ, transversâ, lunari; perist. simplici, acuto, sinuato, margine columellari rapide et anguste reflexâ, et perforationem minutam tegenti.

#### SYNONYMS AND REFERENCES.

*Helix sculptilis* BLAND, N. Y. Lyc. vi. p. 279; Notes, 3, pl. ix. figs. 11-13.

Shell scarcely perforate, suborbicular, depressed, subpellucid, pale horn-color above, of lighter shade beneath, shining, with regular, subequidistant, impressed transverse lines, those on the last

whorl extending over the periphery, and converging in the umbilical excavation; spire very little elevated, scarcely convex; whorls 7, planulate, the last rapidly increasing, equal at the aperture to  $\frac{1}{3}$  the diam. of the shell, beneath flattened, and little excavated in the umbilical region; suture lightly impressed; aperture scarcely oblique, depressed, transverse, lunate; peristome simple, acute, sinuate, the columellar margin very rapidly and narrowly reflected over, and almost entirely covering the very small perforation.

Diam. maj.  $12\frac{1}{2}$ , min. 11, alt. 5 mill.

*Habitat.* "The Anantehely Mountains, which are a local spur of the Alleghany Mountains in North Carolina, just where that State touches Georgia and Tennessee." Bishop Elliott.

A single specimen of this very interesting species was found in the locality above mentioned, by Bishop Elliott, in whose cabinet I noticed it some months ago. In sculpture it is closely allied to *H. indentata* Say, of which it might almost be termed a gigantic variety, but the impressed striæ are more numerous, and closer together. The form of the aperture is very near that of *H. inornata* Binney.

The general aspect of this shell reminds one of the Asiatic group, to which *H. resplendens* Phil. and *H. vitrinoides* Desh. belong.

The above is Bland's description.

**HELIX CELLARIA** MÜLLER.....vol. ii. p. 230, pl. xxix. fig. 4.

*Helix glaphyra* SAY (Binney's ed.) p. 7, pl. 69, fig. 3.

BLAND, N. Y. Lyc. vi. p. 52; Notes, 52—nec PFEIFFER.

*Helix cellaria* DEKAY, l. c. (non cellaria.)

Found in Salem, Lynn, Marblehead, Providence, Connecticut, Portland.

Pfeiffer describes *inornata* under this name.

*Helix glaphyra.* There seems to me no doubt that Dr. Gould and my father are correct in considering this species to have been an accidentally introduced specimen of the European *Helix cellaria* Müll. See the Invert. of Mass. and Terrestrial Mollusks, as well as my Notes on American Land Shells, No. 2, Proc. A. N. S. Phila. That this

is one of those questions which it is quite impossible to settle to the satisfaction of all parties, is proved by the fact of my friend Mr. Thomas Bland having arrived at a different opinion from mine, though furnished with the same data. See Annals of N. Y. Lyceum of N. H. l. c. My decision is based on the following reasoning.

With the exception of the minute species, Mr. Say was acquainted with three shells only of this group, — *Helix lucubrata*, *inornata*, and *glaphyra*. The first mentioned was found in a distinct zoölogical province; consequently, the question lies between *inornata*, as determined by Dr. Binney, and the introduced *cellaria*. The figure given in Nicholson's Encyclopædia, rough as it is, can more readily be referred to *cellaria*. The resemblance to that shell also seems to have struck Mr. Say himself, since he speaks of it in his remarks under its synonym *H. nitens*, as he could hardly do of the larger, less broadly umbilicated *inornata* Binn. The peculiarity of its being "whitish beneath," on which Mr. Say lays particular stress, is more constant in *cellaria*. The description would apply equally to both, with the exception of "umbilicus moderate, not exhibiting the volutions." As regards this phrase, I must say that it seems to contain a contradiction; since any shell must show its volutions more or less in the umbilicus, if it is at all open. A minute perforation, as it is now called, would not show them; but all Say's perforated species are designated as having a "small" umbilicus. The term "moderate" is applied by Say to the umbilicus of *H. tridentata* in the same paper in which the description of *glaphyra* occurs, and subsequently he applies it to *H. septemvolva* alone. The only terms he uses for the umbilicus of his species is "small," "large" or "very large," and "moderate." After a very careful study of his descriptions, I am convinced he used the words "umbilicus moderate, not exhibiting the volutions," in a comparative sense, in con-



tradistinction to his usual term, "umbilicus large, exhibiting the volutions distinctly." Not only could Say have never applied the term "umbilicus moderate" to a perforated shell like *inornata* Binn., but his remarks under *H. ligera* would never apply to it. He says that shell is distinguished from *glaphyra* by having a smaller umbilicus, a condition fulfilled by *inornata* Binn., but evidently quite wanting in *cellaria*. The circumstance of the adoption of the name *glaphyra* by Western Conchologists can have but little weight, since they have not accompanied their lists with descriptions, and have not generally had access to Say's writings. Any one acquainted with the many singular errors abounding in the European treatment of American land shells, will not be surprised to find this species incorrectly determined abroad. Its synonymy now stands:—

*Helix cellaria* MÜLL. anno 1773, LAM. PFEIFFER, &c.

BINNEY, Boston Journ. iii. 421, Nov. 1840; Terrestrial Mollusks, ii. 230, 1851; iii. pl. xxix. f. 4, 1857.

GOULD, Invert. of Mass. 180, f. 104, 1841.

DEKAY, N. Y. Moll. 37, pl. iii. f. 25, 1843.

LINSLEY, Shells of Vt.; Silliman's J. 48, p. 280, 1845.

STIMPSON, Shells of N. E. 55, 1851, *absque descr.*

*Helix glaphyra* SAY, Nich. Enc. vol. iv. Am. ed. pl. i. f. 3, 1816-1819.

FERUSSAC, Tab. Syst. 45, 1822, *absque descr.*

non PFEIFFER, Symbolæ, i. 60, 1841; ii. 80, 1843; non Mon. Hel. Viv. i. 57, 1848; iii. 63, 1853.

non REEVE, Con. Icon.

non DESHAYES, in Fer. pl. lxxxiv. f. 9, 10, teste Pfr.

Those persons who, like my friend Mr. Bland, do not assent to Dr. Binney's determination of *H. glaphyra*, but refer to it *inornata* Binn., are forced to find some shell on which to place Say's name of *inornata*. Mr. Bland would refer it to *lævigata* Pf. There is nothing in Say's description of *inornata* which directly opposes this construction, though it would be strange for Mr. Say to overlook the great peculiarity of *H. lævigata*, its striate upper surface and smooth base. But the habitat, Pennsylvania, which

he gives, would be incorrect of *lævigata*, as far as our present knowledge of geographical distribution will allow me to judge. It would be strange indeed if the thorough researches of so many Conchologists have never proved *lævigata* an inhabitant of that State, if it really exists there, while *inornata* Binn. is met with by every collector among the Alleghanies. Moreover, it must be remembered that it is utterly improbable, although within the bounds of possibility, that a shell confined strictly to damp retired localities in the woods, and found with great difficulty in its native localities, should have been transported fifty or one hundred miles, and picked up on a wharf in a city. Mr. Say speaks of its having been found by Mr. Ord in his garden in Philadelphia; but on making inquiries of that gentleman, I learn that a single empty shell was picked up by him on his wharf, far from any garden, but on the spot where he often found specimens of small foreign animals, accidentally imported in the Liverpool and London ships constantly disembarking their cargoes there. It is a well known fact that some European snails have been widely distributed by commerce. *Limax variegatus* F. is but too common in gardens and cellars of Philadelphia and other maritime cities. *Bulimus decollatus* Lin. (*B. mutilatus* Say) and *Helix aspersa* Müll. are still common in Charleston, S. C.; *Helix hortensis* Müll. has not yet lost its footing on the islands off the coast of the New England States; and this same *Helix cellaria* has been introduced and is still existing plentifully in Boston, New Bedford (J. H. Thomson), Marblehead (J. P. Haskell), Lynn (S. Tufts, Jr.), Halifax (Smithsonian Institute Coll.), Providence (J. G. Anthony, about 1830), Portland, Me. (E. S. Morse). It has never been found in the interior.

Every American author has coincided with my views of *glaphyra* and *inornata*; among them are Binney, Gould,

Adams, DeKay, Linsley, Stimpson. Some of the printed Western catalogues have quoted *glaphyra*, but this has arisen from the authors, in ignorance of the foreign origin of Say's shell, endeavoring to fix the name on some American shell. Abroad, Ferussac gives *glaphyra* by name alone in his *Tableaux Systematiques*, but had never seen the shell. In the continuation of the "Histoire," Deshayes considers *glaphyra* as the introduced *cellaria*, though Pfeiffer gives another name to the shell he figures.

On the other hand, Pfeiffer, in his *Symbolæ*, misconceives *glaphyra*, and also in his *Monographia*, but in a letter to me he says he now considers the shell described in the last-mentioned work as a variety of *inornata* Say. Reeve in *Con. Icon.* doubts Gould's opinion that *glaphyra* is an introduced species; he is right in considering his No. 667 a native American shell, because it is *inornata*, though wrong in applying Gould's opinion to it, as the shell is not mentioned in the *Invertebrata*.

There is also additional evidence of tradition in favor of my views, in the fact of Mr. J. G. Anthony taking to Philadelphia, about the year 1830, a specimen of *cellaria* found in Providence, R. I., and being told by the Conchologists of the former city that it was *glaphyra* Say. Dr. Griffith, also, in letters to my father, now in my possession, writes that the original specimen of *glaphyra* deposited by Say in the collection of the Academy was without doubt *cellaria*, and that it was subsequently broken and thrown aside. This fact destroys the value of a specimen of a young *inornata* labelled by Mr. Phillips as Say's original specimen of *glaphyra*; moreover, Mr. Phillips tells me that he labelled that shell from conjecture.

#### HELIX BULBINA DESHAYES.

##### PLATE LXXIX. FIGURE 10.

T. orbiculato-discoidea, latè umbilicata, tenuis, fragilis, corneo-flava,



pellucida, tenuissime punctulata; spira depressa; anfr.  $5\frac{1}{2}$  planulati, ultimus ad peripheriam obtusissime subangulatus; angulo candidulo; apertura ovato-lunaris, obliqua, coarctata; perist. candidum, tenue, reflexum. Diam. 12, alt. 6 mill. (Deshayes.)

## SYNONYMS AND REFERENCES.

*Helix bulbina* DESHAYES, in Fer. i. p. 108, pl. lxxxv. figs. 14-18.

PFEIFFER, Mon. Hel. Viv. iii. 201.

*Remarks.* This is Deshayes's description of a shell found by him in Ferussac's collection labelled *profunda*. It may be, perhaps, the young of that species. I have given a facsimile of one of his outline figures. Pfeiffer repeats his description, not having seen the shell.

The banks of the Ohio, Mississippi, and Missouri are given as the habitat.

**HELIX DEMISSA** BINNEY.....vol. ii. p. 232, pl. xlii. fig. 1.

*Helix demissa* REEVE, Con. Icon.

**HELIX LUCIDA** DRAPARNAUD .....vol. ii. p. 233, pl. xxii. a, fig. 2.

Found in Ohio.

Having sent some of Dr. Ingalls' shells to Pfeiffer, he declares there is no perceptible difference between them and the *lucida* of Europe.

**HELIX ARBOREA** SAY.....vol. ii. p. 235, pl. xxix. fig. 3.

*Helix arborea* SAY (Binney's ed.) p. 5, pl. lxxii. fig. 5.

CHEMNITZ, ii. 114, (excl. *Ottonis*).

PFEIFFER, iii. 88, (excl. ditto).

REEVE, Con. Icon. No. 733 (1852), excl. syn.

Mighels (Shells of Maine) declares he can see no difference between this and *lucida*.

Pfeiffer, l. c., unites *Ottonis* to this species. He quotes *arborea* from Cuba, but Poey doubts its existence there.

**HELIX ELLIOTTI** REDFIELD.....vol. iii. p. 23, pl. lxxvii. fig. 18.

The description is taken from the New York Lyceum Annals, vi. 170, pl. ix. fig. 10.



**HELIX ELECTRINA** GOULD.....vol. ii. p. 236, pl. xxix. fig. 1.

Pfeiffer (Symb. ii. 10) considers this a variety of *nitidosa*, but subsequently refers it to *pura*, as does also Reeve.

It has also been detected in Georgia and New York.

**HELIX OTTONIS** PFEIFFER.....vol. ii. p. 238, pl. xxix. a, fig. 3.

Also considered a synonym of *arborea* by Reeve, (No. 733.) See the remarks under *H. arborea*.

#### **HELIX STEENSTRUPII** MÖRCH.

In Mörch's catalogue of Greenland Mollusca (Rink's Greenland, p. 75) occurs the following mention of this species, which is the only information I can obtain in regard to it. (See also *H. Fabricii*.)

*Helicella* Steenstrupii, n. s.

*Helicella* sp. Stp. Conch. von Island.

*Helix nitida* Fabr. F. Gr. No. 385.

*Helix alliaria* Forbes, Br. Ass. 1839, 142.

**HELIX CAPSELLA** GOULD.....vol. ii. p. 239, pl. xxix. a, fig. 1.

*Helix rotula* PFEIFFER, Mon. Hel. Viv. iii. 107.

*Helix placentula* SHUTTLEWORTH, (Zonites) Bern. Mit. 1852, 194.

GOULD, in Terr. Moll. iii. 19.

My opinion regarding the identity of *placentula* is founded on the description alone, not having seen any authentic specimen.

**HELIX VORTEX** PFEIFFER...vol. ii. p. 240, pl. xxix. a, fig. 2, vol. iii. p. 34.

*Helix vortex* PFEIFFER, Ar. f. Nat. 1839, ii. 351; Mon. Hel. Viv. i. 95; iii. 88.

CHEMNITZ, ed. 2, ii. 110, pl. lxxxviii. figs. 7-9.

REEVE, Con. Icon. No. 644, (1852).

GOULD, vol. iii. l. c.

*Helix selenina* REEVE, l. c. 716, (1852).

I have seen no specimens from America of the larger variety of the species found in the West Indies.

The species is found also in Haiti, St. Thomas, Porto Rico, Bermuda, and Cuba ; and in Georgia, (Gould).

I very much doubt the identity of *tenuistriata* with this species. (See remarks in the following article).

#### HELIX TENUISTRIATA BINNEY.

The following description I found among my father's papers. It is impossible to apply it to any known American species. It will, however, probably be rediscovered at some future time. Its habitat, size, and all its characteristics, are opposed to the theory of its identity with the preceeding species, as suggested by Gould.

H. testâ depressâ, carinatâ, umbilicatâ, albido-cornea ; anfractibus septem, oblique striatis ; aperturâ angustâ, depressâ ; labro sub-reflexo ; basi convexo ; umbilico aperto.

#### SYNONYMS AND REFERENCES.

*Helix tenuistriata* BINNEY, Boston Journal, 1842, iv. i. cover, p. 3.

PFEIFFER, Mon. Hel. Viv. i. 432.

*Helix vortex* GOULD, (non PFEIFFER,) Terr. Moll. iii. 34.

#### DESCRIPTION.

*Animal* not hitherto noticed.

*Shell* flattened, the upper surface acutely carinated ; *epidermis* light horn-color ; *whorls* seven, narrow, increasing in width very gradually from the apex to the aperture ; striated with fine, prominent, distinctly separated, curved lines ; aperture angular, depressed, contracted ; lip above the carina acute, below a little reflected ; base sub-convex, smooth ; umbilicus open, moderate in size, exhibiting two or three volutions.

Greatest transverse diameter about half an inch.

*Geographical Distribution.* Found hitherto only in the eastern part of Tennessee, whence a single specimen was brought by Mr. Haldeman.

*Remarks.* This pretty species is described with some reluctance from a single specimen, as it may be considered doubtful until another be found, whether it may not be a foreign shell introduced by mistake among Tennessean shells. It is quite flat on the upper

surface, rising a little towards the apex; the whorls, which are distinctly marked, are beautifully striated with delicate prominent curved lines, which are crowded towards the apex, and separated by a distinct interval on the outer whorl; they terminate on the edge of the carina, which is a little plaited by them, the base below being smooth. The aperture is narrow, and marked by an angle at the carina. The lip below the carina has a distinct, though narrow reflection. The umbilicus is moderate, conical, and rather deep, exhibiting about three volutions. In Lamark's arrangement it would be a *Carocolla*.

**HELIX INDENTATA** SAY.....vol. ii. p. 242, pl. xxix. fig. 2.

*Helix indentata* SAY, (Binney's ed.) p. 24.

CHEMNITZ, i. 221, (1846).

REEVE, Con. Icon. No. 730, (1852).

PFEIFFER, l. c. iii. 65.

Found also in Florida, Canada, and Texas, (Moore). For its supposed presence in St. Domingo, see Mal. Bl. 5, 147.

**HELIX CHERSINA** SAY.....vol. ii. p. 243, pl. xvii. fig. 4.

*Helix chersina* SAY, (Binney's ed.) pp. 18, 31.

*Helix fulva* teste MIGHELS, (Bost. Journ. iv. 333,) CHEMNITZ, PFEIFFER, REEVE, FORBES and HANLEY.

I have separated the synonymy of *H. egena* Say, from that of *chersina*, since many authors consider them distinct. The typical *chersina* is well represented in the plate. The original specimen of *egenæ* is readily distinguished from it by having a short, pyramidal, acute spire, and a very rounded base, the separation of the two being very well defined. There exist, however, innumerable gradations between these extreme forms. It must be borne in mind, that the shell figured and described by Gould on p. 245, is not *egenæ* Say, but *Gundlachi* Pfr.

I give Say's description below.

**H. EGENA.** Shell convex, polished; whorls five, not distinctly wrinkled, rounded; aperture rather narrow, transverse; labrum

simple, at its inferior extremity terminating at the centre of the base of the shell; umbilicus none, but the umbilical region deeply indented.

Breadth more than one tenth of an inch.

This shell was found by Mr. John S. Phillips on the banks of the Delaware River, about ten miles from Philadelphia. It is much more elevated and not so broad as *H. arborea* Nobis; the aperture also is of a different shape. It is much broader than the *H. chersina* Nob.

#### SYNONYMS AND REFERENCES.

*Helix egena* SAY, (Binney's ed.) p. 30.

DEKAY, N. Y. Moll. p. 45.

CHEMNITZ, ed. 2, i. 237, pl. xxx. figs. 19-21? (1846).

REEVE, Con. Icon. No. 1263, (1854.)

PFEIFFER, Mon. Hel. Viv. i. 31; iii. 32, non GOULD.

#### HELIX FABRICII BECK.

##### PLATE LXXVII. FIGURE 17.

T. subimperfata, conica, tenuis, striatula, pellucida, fulva; spira conica, acutiuscula; sutura profunda; anfr. 6, convexi, angusti, ultimus lator, basi convexiusculus, medio impressus; apertura verticalis, latè lunaris; perist. simplex, acutum, margine columellari superne reflexiusculo, perforationem simulante. (Pfeiffer.)

#### SYNONYMS AND REFERENCES.

*Helix Fabricii* BECK, Ind. p. 21, (absq. desc.)

MÖLLER, Ind. Moll. Grœnl. p. 4.

PFEIFFER, Zeit. f. Mal. 1848, p. 90; Mon. Hel. Viv. iii. 32.

REEVE, Con. Icon. 1459, (1854).

*Helix nitida* FABRICIUS, Fauna Gr. p. 389, teste PFR. et MÖLL.

*Conulus Fabricii* MÖRCH, 1857, Nat. Bidr. af Gr. 75, (absq. desc.)

*Remarks.* I have not seen this shell. The figure, which is enlarged, is a fac-simile of that given by Reeve from the Cumingian Collection. The description is Pfeiffer's. He also remarks that the shell is hardly distinguished from *fulva* Drap. by its more convex, subperforated base. It is a Greenland species.

Fabricius thus describes *H. nitida*, which is quoted as a synonym:—



*Helix nitida*, testa umbilicata, subdepressa, fulvo-cornea, pellucida, substriata, apertura larga.

*Helix nitida* Müll. prodr. 2898, Verm. 234.

*Helix Hammonis*, Act. Nidr. iii. 435, tab. vi. fig. 16.

Hujus testam vacuum tantum sub muscis rarissime offendi.

**HELIX GUNDLACHI** PFEIFFER. . . . . vol. ii. p. 245, pl. xxii. a, fig. 3.

*Helix Gundlachi* PFEIFFER, Wieg. Arch. 1840, i. 250, Mon. Hel. Viv. i. 50; iii. 51.

CHEMNITZ, ed. 2, i. 239, pl. xxx. figs. 25-28.

*Helix pusilla* PFEIFFER, Ar. f. Nat. 1839, i. 351, nec. LOWE.

*Helix egena* GOULD, l. c. nec SAY.

This is not *egena* SAY, as stated in the remarks under *H. chersina*. Having sent some of the specimens received from Gould to Pfeiffer, I have received from him an assurance of their being identical with his *Gundlachi*, a Cuban species. His description is as follows:—

T. subperforata, turbinato-depressa, nitida, fulva; anfr. 5 convexiusculi, lente accrescentes, ultimus basi subplanulatus, sub lente lineis concentricis sculptus, circa perforationem excavatus; apertura depressa, lunaris; perist. simplex, rectum, acutum. Diam. maj.  $2\frac{1}{2}$ , min.  $2\frac{1}{2}$ , alt.  $1\frac{3}{8}$  mill.

Similis speciminibus junioribus *H. fulvæ*.

**HELIX INTERNA** SAY. . . . . vol. ii. p. 247, pl. xxx. fig. 4.

*Helix interna* SAY, (Binney's ed.) p. 18.

CHEMNITZ, i. 200.

REEVE, Con. Icon. No. 718, (1852).

PFEIFFER, l. c. iii. 142.

**HELIX GULARIS** SAY. . . . . vol. ii. p. 251, pl. xxxvii. figs. 3, 4.

*Helix gularis* SAY (Binney's ed.) p. 18.

CHEMNITZ, ii. 201, excl. var.

PFEIFFER, l. c. iii. 141, excl.  $\beta$ ; Symb. ii. 29, excl.  $\beta$ .

MRS. GRAY, Fig. Moll. An. pl. 291, fig. 4, Ex Bost. Journ.

ADAMS, (*Gastrodonta*) Gen. Rec. Moll. pl. lxxi. fig. 4.

REEVE, Con. Icon. No. 719, (1852).

*Helix bicostata* PFEIFFER, l. c. i. 182; iii. 141; Symb. iii. 69.

CHEMNITZ, ed. 2, ii. 196, pl. 100, figs. 21-23.

REEVE, l. c. 697 (1852).

Pfeiffer, l. c., considers *H. suppressa* a variety of *gularis*. His *bicostata* is evidently the true *gularis*, with a less elevated spire. He acknowledges it to be so in letters lately received by me.

See also remarks on *ligera* for *H. Rafinesquea*.

**HELIX SUPPRESSA** SAY.....vol. ii. p. 253, pl. xxxvii. fig. 1.

*Helix suppressa* SAY, (Binney's ed.) p. 36.

DEKAY, N. Y. Moll. p. 38, pl. iii. fig. 24.

REEVE, Con. Icon. No. 723, (1852).

*Helix gularis*, var. CHEMNITZ, l. c.

PFEIFFER, l. c.

The typical specimen is still preserved in the Philadelphia Academy.

Pfeiffer considers it as a variety of *gularis* furnished with one tooth only. DeKay also mentions but one tooth.

I have specimens from Alabama and Florida. It has been found by me only in fields at the roots of the grass, and not under decaying leaves and stumps as the other species.

**HELIX LASMODON** PHILLIPS.....vol. ii. p. 254, pl. xxxvii. fig. 2.

*Helix lasmodon* DEKAY, N. Y. Moll. p. 47.

PFEIFFER, Mon. Hel. Viv. iii. 142.

*Helix macilenta* SHUTTLEWORTH, Bern. Mit. 1852, p. 195.

GOULD, Terr. Moll. iii. 20.

PFEIFFER, l. c. iii. 640.

I have seen no authentic specimen of Shuttleworth's species, but am inclined from the description to place it in the synonymy of *lasmodon*. It had not been seen by Pfeiffer or Gould, who repeat the original description.

**HELIX PERSPECTIVA** SAY.....vol. ii. p. 256, pl. xxx. fig. 1.

*Helix perspectiva* SAY, (Binney's ed.) p. 9.

DESHAYES, 3d ed. Lam. iii. 315, (1839); in Fer. Hist. i. 81.

PFEIFFER, l. c. iii. 99, (excl. *H. fliola*).

CHEMNITZ, ii. 114.

REEVE, Con. Icon. No. 695, (1852).

*Helix patula* DESHAYES, non *parrula*.

Occurs fossil in the Natchez Postpleiocene bluff.

The existence of the tooth within the aperture has been overlooked by all other authors but Binney. The position of the species in the artificial systems is materially altered by its presence.

Pfeiffer quotes Ferussac's pl. 86, fig. 1, for this species, and places pl. 79, fig. 7, in the synonymy of *H. striatella*. The former is said by Deshayes to be *filiola*, a species from Tonga, while the latter was figured from a specimen furnished by Say himself.

Potiez and Michaud give Austria as the habitat of *perspectiva*, having confounded it with *solaria* Menke (Gal. p. 99.)

**HELIX MULTIDENTATA** BINNEY, .....vol. ii. p. 258, pl. xlviii. fig. 3.

*Helix multidentata* CHEMNITZ, ii. 202.

PFEIFFER, iii. 142.

REEVE, Con. Icon. No. 729, (1852).

Found also in Ohio (Anthony), and in Maine (Morse).

Gould is erroneously quoted as authority for the specific name by all the foreign writers referred to in the synonymy.

**HELIX LINEATA** SAY.....vol. ii. p. 261, pl. xlviii. fig. 1.

*Helix lineata* SAY, (Binney's ed.) pp. 9, 24.

CHEMNITZ, ii. 203.

PFEIFFER, iii. 142.

DESHAYES, in Fer. i. 80.

REEVE, Con. Icon. No. 724, (1852).

Found also in Virginia, and in Washington Co., Texas, (Moore.)

#### SPURIOUS SPECIES.

*Helix arbustorum* Lin. was found some years since in the neighborhood of Cincinnati; it was living in a situation from which it

could be traced to a nursery, the proprietor of which had imported many fruit-trees and bushes from France, and had probably brought over this stray species in the matting around their roots. (Anthony.)

*Helix Bonplandi* Lamark, vid. vol. i. p. 159.

*Helix corpuloides* Mont. is quoted from Boston, without description, among DeKay's extra limited species. On the page of Silliman's Journal, to which he refers, it is stated by Gould to be a species of "*Delphinoidea*," originally described as *Helix*.

*Helix harpa* Say is a *Bulimus*.

*Helix dealbata* Say is a *Bulimus*.

*Helix depicta*, Grateloup, vid. vol. i. p. 159.

*Helix domestica*, Strom, vid. *Vitrina Angelicæ*.

*Helix hieroglyphica* Beck, Ind. p. 8. "Am. Sept.?" No description is given. The species is unknown to Pfeiffer. Vid. Mon. i. 434.

*Helix hispida* Linnæus, Canada?

*Helix irrorata*. Shell imperforate, depressed, subglobular, pale reddish-brown, with very numerous small white spots, and about four deeper brown obsolete bands; whorls rounded, nearly five in number, wrinkles obsolete on the body whorl, more distinct on the spire; spire depressed, convex; suture declining much near the mouth; aperture on the side of the labrum, within somewhat livid; labrum reflected but not flattened, and not abruptly contracting the aperture, white before and yellowish behind; near the junction with the columella is a callus, which does not rise into an angle.

Length from the apex to the base of the columella, three-fifths of an inch nearly. Greatest breadth one and one-tenth of an inch. Inhabits Northumberland County, Pennsylvania. Cabinet of Mr. William Hyde.

This species may be compared with the *H. lactea* Müller and Ferrussac; the spire is rather more prominent, the white spots, or rather abbreviated lines are similar in form, size, and number, but its labrum preserves the same color with the exterior of the shell, and the livid tint of the inner portion of the body whorl is very



pale; the posterior face of the reflected labrum is immaculate, and its callus base is not angulated; the aperture is much less wide than that of *lactea*; and in Mr. Hyde's specimen, a small fissure remains near the umbilicus. It still more closely resembles a variety of a shell which inhabits the Island of Candia, but that species has always a white base, being immaculate beneath the inferior band. Say, (l. c.)

It seems probable that *Helix irrorata* is a variety of *H. lactea* Müll., with which I compared it when describing it. Say, (Binney's ed.) p. 36.

*Helix irrorata* SAY, (Binney's ed.) p. 23.

DEKAY, N. Y. Moll. 45, (var. of *lactea*).

PFEIFFER, Mon. i. 272.

*Helix lactea* MÜLLER, teste BINNEY, PFEIFFER, (iii.) REEVE, SAY.

*Helix nemoralis* Lin. teste Gray, Turtóns, Man. 27, ("Canada and United States.")

*Helix pellucida* Fabricius, vid. *Vitrina Angelicæ*.

*Helix pisana* Müll. quoted from U. S. by Ferussac, (Tabl. Syst.) and Gray (Turt. Man.)

*Helix subcylindrica* Pulteney is a *Truncatella*.

*Helix Trumbulli* Linsley. (Shells of Connecticut, p. 10; Sill. Journ. 48, p. 280). Spire much depressed or very little elevated; sutures slightly marked and umbilicus large and deep; color a dull white with a tinge of green; shell thin and translucent; diameter about  $\frac{11}{100}$  inch, height  $\frac{1}{20}$  inch; found on the shore of Long Island Sound near high-water-mark, and occasionally near low-water-mark at Stonington, by Mr. J. H. Trumbull. [May not this be *Margarita arctica*? Eds.]

"*Helix Trumbulli* is *Skenca serpuloides*." Gould, Silliman's Journ. n. s. vi. 235.

*Helix virgata* Mont. "United States," Ferussac, Tabl. Syst.

#### GENUS BULIMUS SCOPOLI.

**BULIMUS ZEBRA** MÜLLER. . . . . vol. ii. p. 271, pl. liv.; pl. lxxvii. fig. 13; pl. lxxviii. fig. 12.

For additional synonyms, &c. see Pfeiffer.

On pl. 78, fig. 12, is a variety of this species from Key

Biscayne, Florida. The variety described on page 273 is figured on pl. 77, fig. 13.

*Agatina fuscata* Rafinesque (vol. i. p. 50) is to be added to the synonymy.

**BULIMUS SERPERASTRUS** SAY.....vol. ii. p. 274, pl. 1. fig. 2.

*Bulimus serperastrus* SAY (Binney's ed.) p. 39.

CHEMNITZ, ed. 2, p. 82, pl. xxx. fig. 122; pl. xxxix. fig. 5, (1854).

PFEIFFER, l. c. iii. 341.

PHILIPPI, Icon. iii. 23, p. 97, tab. 9, fig. 6.

$\beta$  Gracilior, spira elongata.

*Bulimus Liebmanni* PFEIFFER.

*Bulimus Ziebmanni* REEVE.

$\gamma$ . Minor, imperfectus.

*Bulimus nitelinus* REEVE.

The above varieties are given solely on the authority of Pfeiffer.

The geographical distribution of the species doubtfully quoted by Gould as synonyms seem to remove the probability of their identity with this shell.

**BULIMUS ALTERNATUS** SAY.....vol. ii. p. 276, pl. li. fig. 2; pl. li. a; pl. lxxx. fig. 3; fig. 1?

*Bulimus alternatus* SAY (Binney's ed.) p. 39.

PFEIFFER, Mon. Hel. Viv. ii. 221.

*Bulimus lactarius* PFEIFFER, l. c. ii. 187; iii. 415.

REEVE, l. c. No. 217.

GOULD, Ter. Moll. iii. p. 35.

*Bulimus dealbatus* BINNEY, l. c. pars, nec Say.

There exists a great deal of confusion in regard to this and the allied species.

*Bulimus alternatus* is thus described by Say:—

**BULIMUS ALTERNATUS.** Ovate conic, with alternate gray and brownish longitudinal vittæ. Inhabits Mexico.

Shell umbilicated, ovate-conic, with longitudinal lines, subequal, gray and light brownish vittæ; the brown is paler, almost approaching in some instances a drab; the white vittæ consists of more or

less confluent, transverse, irregular lines, and small spots; whorls about six, a little convex; suture not profoundly impressed; labrum (in some specimens) with a thickened line or rib on the inner submargin; within white, with a perlaceous tinge.

Length one and one fifth of an inch. Greatest breadth seven tenths. This species appears to be not uncommon in Mexico, as many specimens were sent me by Mr. Maclure; but from what particular locality, I know not.

An original drawing of this species by Mrs. Say, under which is written, in the hand of her husband, "*Bulimus alternatus* — Mexico, Wm. Maclure," is copied on plate 80, fig. 3. This figure, in connection with the description, removes all doubt as to what shell Say had before him as *alternatus*.

It is, however, an extremely variable shell, being found on the same bush in large quantities, among which is every variety of marking. Some specimens exist without hardly any white in their coloring, as in the case of the specimen from Buena Vista figured (pl. 80, fig. 1), while some are but slightly varied with the brown vittæ.

*B. alternatus* occurs in large quantities in Texas and the neighboring Mexican State of Tamaulipas. Adams also quotes it from Louisiana, on the authority of one dead specimen found in Otter Creek, (Nat. Hist. Red Riv. La. p. 254).

Forbes, in the description of land-shells collected by the Herald and Pandora, P. Z. S. 1850, p. 54, speaks of "*Bul. alternatus*" being found at Panama. He gives no authority for the name; Pfeiffer describes no other *alternatus* than Say's.

Binney was familiar with *B. alternatus*, as he figured it on pl. li. a, and a variety of it on pl. li. fig. 2. He considered it, however, a variety of *B. dealbatus*.

Pfeiffer alone, of foreign writers, notices *B. alternatus*, by repeating Say's description as of a species unknown to

him. It appears that he had the true *alternatus* before him in describing *B. lactarius* as follows:—

T. rimata, vel perforata, ovato-acuta, palidissimè fulvida, strigis lacteis, opacis, longitudinalibus, denticulatis et fimbriatis ornata; spira conica, acuta; anfr. 7 convexiusculi, ultimus spiram subæquans; apertura ovalis; perist. simplex, acutum, marginibus callo junctis, columellari dilatato, reflexo. (Pfr. in Symb. iii. 85.)

Reeve also describes and figures the species as *B. lactarius*.

#### BULIMUS MARLÆ ALBERS.

T. anguste umbilicata, oblongo-conica, solida, sublævigata, alba, punctis et strigis obsoletis corneis plerumque notata; spira conica, acuta; anfr.  $6\frac{1}{2}$  convexiusculi, ultimus spiram subæquans, basi vix attenuatus; columella plica parvula, dentiformi munita; apertura vix obliqua, acuminato-oblonga, intus fusca; perist. rectum, margine dextro leviter arcuato, columellari sursum dilatato, patente. Long. 33, diam. 14-15 mill.; ap. 16-17 mill. longa,  $7\frac{1}{2}$  lata.

β. Anfr. superis corneis, lacteo punctato-strigatis, ultimo strigis lacteis denticulatis et violaceo-corneis alternantibus picto.

Hab. Texas.

This description was published by Pfeiffer in Proc. Zool. Soc. London, 1858, p. 23. The species must be nearly allied, if not identical, with some of the varieties of *B. alternatus*,—but I have not seen any authentic specimen.

#### BULIMUS BINNEYANUS PFEIFFER.

##### PLATE LI. b.

The shells figured on the plate referred to were considered as a variety of *dealbatus* by Binney (ii. 277), and as *B. Schiedeanus* by Gould (ii. 279). Having sent specimens to Pfeiffer for identification, they were returned to me labelled *B. Binneyanus*, with the remark that the true *B. Schiedeanus* has no tooth-like plate on the columellar.

The shell described by Pfeiffer (Mal. Blatt. iv. 229) does not appear to be identical with our Texan shell. We



must therefore leave the species temporarily under this name, until its position is more accurately ascertained.

### **BULIMUS SCHIEDEANUS PFEIFFER.**

PLATE LXXX. FIGURES 8, 15.

*T. perforata*, ovato-acuta, calcarea, alba, longitudinaliter et irregulariter rugoso-striata; anfr.  $6\frac{1}{2}$  convexiusculi, ultimus spiram æquans; apertura ovali-oblonga, intus fulvida; columella obsoletè plicata; perist. simplex, acutum, marginibus callo nitido junctis, columellari late reflexo, nitido, albo. Long. 31, diam. 17 mill. Ap. 17 mill. longa, 9 lata. (Pfr.)

#### SYNONYMS AND REFERENCES.

*B. Schiedeana* PFEIFFER, Symb. ad Hel. Hist. i. 43; Mon. Hel. Viv. ii. 187; iii. 418.

CHEMNITZ, ed. 2, No. 216, pl. xlv. figs. 3, 4, (1854).

PHILIPPI, Icon. i. 3, p. 56, pl. 1, fig. 12.

REEVE, Con. Icon. No. 361

*Geographical Distribution.* Texas and Mexico.

*Remarks.* This species is readily distinguished from that figured on pl. 51, b, (see last article,) by its rougher surface and the want of the tooth-like fold on the columellar.

Pfeiffer mentions a smaller variety. I have figured two others. One (pl. 80, fig. 15) has a very dark-colored aperture. The other (pl. 88, fig. 8) is distinguished by a smoother surface, a black apex, a light coffee-color below an obtuse carina situated about the middle of the body whorl, the remainder of the shell being quite white. It was found in Washington and De Witt Counties, Texas, (Moore). The other forms were not found with it. It occurred in large numbers, living, and constant in its characters through every stage of growth. Should it prove a distinct species, I would suggest its bearing the name of the discoverer.

### **BULIMUS PATRIARCHA.**

PLATE LXXX. FIGURE 13.

*T. perforata*, ovato, solidissima, alba, rugosa; anfr. 6 convexi, ultimus

ventricosus, 5-7 long. testæ æquans; apertura ovata; perist. simplex, intus incrassatum, marginibus callo albo, crasso, junctis, columellari reflexo, umbilicum subtegente.

## SYNONYMS AND REFERENCES.

*Bulimus patriarcha* W. G. BINNEY, Proc. Phila. Acad. Nat. Sc. 1858, 116; Notes, p. 17.

## DESCRIPTION.

*Animal* not observed.

*Shell* perforate, ovate, heavy, white, and wrinkled; whorls 6, convex, the last ventricose, equalling in length 5-7 of the shell; aperture ovate; peristome simple, thickened within, the extremities joined by a heavy white callus, the columellar extremity slightly reflected, so as partially to conceal the umbilicus.

Length 35, diam. 19; aperture, length 19, diam. 12 millimetres.

*Geographical Distribution.* Texas and Mexico, at Buena Vista, (Berlandiere).

*Remarks.* Belongs to the same group as *Bul. dealbatus* Say, *alternatus* Say, *liqualis* Reeve, *Schiedeanus* Pf., &c. The characteristics which form its specific differences are alike present in young and old specimens, and constant in all from the locality. I therefore consider it as well entitled to specific distinction as those named.

Named from its greater size and more antiquated appearance, as compared with the allied species.

**BULIMUS DEALBATUS** SAY. .vol. ii. p. 276, pl. li. fig. 1; pl. lxxx. figs. 6, 7.

*Helix dealbata* SAY, (Binney's ed.) p. 20.

DEKAY, N. Y. Moll. p. 46.

*Bulimus dealbatus* CHEMNITZ, ed. 2, p. 55.

PFEIFFER, l. c. iii. 418.

*Bulimus confinis* REEVE, Coll. Icon. No. 643, (1850).

PFEIFFER, l. c. iii. 341.

*Bulimus liquabilis* REEVE, l. c. 387.

On plate 51, fig. 1, will be found a correct representa-

tion of what appears to me the type of *Bul. dealbatus*. The species varies considerably, but never sufficiently to authorize the quotation of *alternatus*, *Binneyanus*, *Schiedeanus*, and *patriarcha* as synonyms.

It is found in large quantities in Texas, Alabama, North Carolina, Missouri, and Arkansas. Future researches will probably prove it an inhabitant of the neighboring South-western States. It also occurs fossil in the Postpleiocene.

Say's description is as follows:—

H. DEALBATA. Shell conical, oblong, thin and fragile, somewhat ventricose; volution 6-7, wrinkled across, wrinkles more profound and acute on the spire; spire elevated, longer than the aperture, sub-acute; aperture longer than wide, labrum not reflected; umbilicus small and profound.

Length more than three-fourths of an inch, breadth nine-twentieths of an inch. In the Cabinet of the Academy and Philadelphia Museum. Inhabits Missouri and Alabama. -

In outline it resembles a *Bulimus*. Four specimens of this species were sent to the Academy from Alabama, by Mr. Samuel Hazard; and a single depauperated specimen was found by myself on the banks of the Missouri.

*Bulimus physoides* Reeve (No. 507) corresponds exactly to a variety of *dealbatus* sent from Alabama by Dr. Showalter. It is quoted by Pfeiffer (iii. 418) as a synonym of *B. melo* Quoy.

Pfeiffer quotes *B. liquabilis* Reeve as a variety of *B. confinis* Reeve. I am inclined to consider them both as varieties of *dealbatus*—but subjoin Reeve's descriptions, having copied his figures respectively on pl. 88, figs. 6 and 7.

BULIMUS CONFINIS. Bul. testâ ovatâ, subventricosâ, profundè umbilicatâ, anfr. 6, rotundatis, tenuè striatis, columellâ latè dilatatâ, subreflexâ, aperturâ orbiculari, labro simplici; pellucido-corneâ, opaco-albido variegatâ. Hab. Texas.

BULIMUS LIQUABILIS. Bul. testâ ovato-conicâ, ventricosâ, umbili-

catâ, anfr. 6 ad 7, subrotundatis, lævibus vel minutè striatis, columellâ latè reflexâ, labro tenui, paululum expanso; pellucido-corneâ, strigis longitudinalibus opacis notatâ. Hab. Texas.

**BULIMUS MULTILINEATUS** SAY.....vol. ii. p. 278, pl. lviii.

*Bulimus multilineatus* SAY, (Binney's ed.) p. 28.

DEKAY, N. Y. Moll. 56.

PFEIFFER, Mon. Hel. Viv. ii. 204; iii. 422.

*Bulimus virgulatus* BINNEY, l. c. nec FERUSSAC.

There can, I think, be no reasonable doubt of the identity of the species figured on pl. 58 with Say's species. The shells figured were found by Bartlett on the Florida Keys. Similar specimens have lately been sent to the Smithsonian Institute from Lower Matacumba Key.

As regards *B. venosus*, Reeve's figure agrees exactly with the Florida shell, but he gives as its habitat the banks of the Orinoco. At all events, Say's name has many years of priority. Reeve quotes *Grunei* as a synonym of *venosus*.

Pfeiffer repeats Say's description, having seen no authentic specimen.

*Bul. virgulatus* Fer. is quite another shell.

Say's description is given below.

**BULIMUS MULTILINEATUS.** Shell conic, not very obviously wrinkled; whorls not very convex, yellowish white, with transverse entire reddish-brown lines; a blackish subsutural revolving line; suture not deeply indented, lineolar; apex blackish; umbilicus small, surrounded by a broad blackish line; columella whitish; labrum simple, blackish.

Length less than seven-tenths of an inch. Greatest breadth less than seven-twentieths of an inch. This species was found by Mr. Titian Peale on the southern part of East Florida.

It is quite distinct from *Bul. Dormani*, but appears somewhat related to *Bul. Floridianus*.

#### **BULIMUS DORMANI.**

PLATE LXXX. FIGURE 10.

Testa perforata, ovato-turrita, lævigata, albida, fasciis fuscis longitudi-



nalibus ornata; sutura impressa; spira elongato-conica, acuta; apex punctulata; anfr. 6 convexiusculis, lineis minutissimis volventibus ornati, superi striati, ultimus inflatus, ad marginem superam peristomatis obtusissimè carinatus; apertura ovata, partem testæ dimidiam subæquans; perist. simplex, acutum, margine columellari reflexiusculum, perforationem pene occultans.

## SYNONYMS AND REFERENCES.

*Bulinus Dormani* W. G. BINNEY, Proc. Phila. Acad. Nat. Sc. 1857, p. 188; Notes, p. 8.

## DESCRIPTION.

*Animal* not observed.

*Shell* perforated, rather heavy, shining, elongated-conic; white, with several regular revolving series of interrupted, perpendicular, reddish-brown patches; suture distinctly marked; apex punctured; whorls 6, rather convex, marked with numerous very fine revolving lines; upper whorls striate; last whorl full, with a hardly perceptible obtuse carina at the upper extremity of the peristome.

Length, 29; diameter, 12 millimetres.

*Geographical Distribution.* Found at several spots in the vicinity of St. Augustine, Fla., by O. S. Dorman, Esq.

*Remarks.* The only described species with which this shell can be confounded is *B. Floridianus* Pfr., Proc. Zool. Soc. London, 1855, p. 330. Though I have never seen Dr. Pfeiffer's shell, I should consider it nearly allied, though distinct. That species wants the minute revolving lines, the punctured apex, and striate upper whorls, which characterize *B. Dormani*, is a smaller shell, and has a different marking, being furnished with opaque whitish blotches as well as reddish patches; the latter also do not extend to the body whorl.

Since writing the above, I have received a drawing of the type of *B. Floridianus* which removes all doubt of its being identical with this species.

**BULIMUS FLORIDIANUS** PFEIFFER.

PLATE LXXIX. FIGURE 3.

*T. angustè* perforata, ovato turrita, sublævigata, griseo-hyalina, strigis et maculis opacis, albis notata; spira elongato-conica, acutiuscula; anfr.  $6\frac{1}{2}$  convexiusculis, superis interruptè fusco-fasciatis, ultimo  $\frac{3}{4}$  longitudinis subæquante, infra medium subangulato, basi attenuato; columella subtorta, recedente; apertura parum obliqua, ovali; perist. tenui, margine dextro angustè expanso, columellari dilatato, reflexo, fere adnato.

Long.  $15\frac{3}{8}$ , diam.  $7\frac{1}{2}$  mill.

Habitat, Florida. (Pfr.)

The above is the original description of this species, (Proc. Zool. Soc. July, 1856, p. 330). I have not seen any specimen of it, but am able to add a figure drawn by Sowerby from the type in the Cumingian collection.

It appears nearest allied to *B. multilineatus*.

**BULIMUS DECOLLATUS** LINNÆUS.....vol. ii. p. 280, pl. l. fig. 1.

*Bulimus mutilatus* SAY, (Binney's ed.) p. 25.

DEKAY, N. Y. Moll. p. 56.

PFEIFFER, l. c. 397.

In 1857 I received a large quantity of this species alive from Prof. Holmes of Charleston, S. C. From him I learn that the species is still but too common in that city. I placed a large quantity of them in my garden in Burlington, but they did not survive the succeeding winter.

Reeve gives no habitat, and no authority for the specific name.

It has also been introduced into Cuba, (Poey, Pfeiffer).

The animal is carnivorous.

**BULIMUS SUBULA** PFEIFFER.....vol. ii. p. 285, pl. liii. fig. 4.

*Bulimus subula* PFEIFFER, l. c. iii. 399.

*Bulimus hortensis* ADAMS, vid. PFEIFFER, Mal. Blatt. i. 196; also vid. Contr. to Conch. p. 221.

**BULIMUS GRACILLIMUS** PFEIFFER.....vol. ii. p. 293, pl. liii. fig. 3.

*Bulimus gracillimus* PFEIFFER, l. c. iii. 394.

REEVE, Con. Icon. No. 594, (1849).

*Achatina gracillima* BINNEY, l. c.

I have removed this species to the genus in which Pfeiffer places it.

**BULIMUS GOSSEI** PFEIFFER.

*T. rimata*, turrito-cylindracea, obliquè costulata, albida, opaca, strigis semilunaribus, punctisque pellucidis corneis ornata; spira cylindracea apice attenuata, acuta; sutura crenulata; anfr. 11 convexi, ultimus  $\frac{1}{4}$  longitudinis vix superans, rotundatus, basi subangulatus; apertura subcircularis; perist. breviter expansum, marginibus approximatis, columellari reflexo, patente. Long. 11, diam.  $3\frac{2}{3}$  mill. Ap.  $3\frac{1}{2}$  mill. longa,  $3\frac{1}{2}$  lata.

*Var.  $\beta$* , Paulo minor, strigis et punctis corneis obsoletioribus, (Pfr. Mon. Hel. Viv. i. 81, &c. &c.)

Pfeiffer gives Texas as the habitat of var.  $\beta$  of this species in his Monograph, and also on p. 456 of Roëmer's Texas it is quoted from New Brauenfels. The typical specimen is from Jamaica.

Poe (Mem. i. 395) considers *Macroceramus pontificus* a synonym of *Bul. Gossei*; the same species is referred by Pfeiffer to *Bul. Kieneri*.

I have seen no Texan specimen of the species, and have no means of clearing the confusion which appears to exist concerning it. Reeve's figure of *Kieneri* resembles *Macr. pontificus* nearer than his figure of *Gossei*.

**BULIMUS HARPA** SAY..... vol. ii. p. 290, pl. lii. fig. 3.

*Helix harpa* SAY, (Binney's ed.) p. 29, pl. lxxiv. fig. 1.

*Bulimus harpa* PFEIFFER, l. c. iii. 384.

CHEMNITZ, ed. 2, No. 305, pl. lx. figs. 17-19.

REEVE, Con. Icon. No. 596, (1849).

Found at various points in Maine, and at Berlin Falls, N. H., by E. S. Morse, Esq., who gives the following description of the animal:—

Animal small compared to the size of the shell. Body and head

slate-color, superior tentacles darker, short, thick, bulbous; eyes large, distinct; foot two-thirds of the length of shell; whitish, long, very narrow, rounded at tail; body narrower than foot.

In motion they are exceedingly graceful, at times poising their beautiful shell high above their body, and twirling it round not unlike the *Physa*, again hugging their pretty harp close to the back; the shell when in this last position continually oscillates as if the animal could not balance it. It rarely ever moves in a straight line, but is always turning and whisking about, and this is done at times very quickly and abruptly.

Mighel's description of *Pupa costulata* is as follows:—

Shell ovate-conic, scalariform, light yellowish-brown, thin and fragile, whorls four, convex, the last two prominently ribbed, the first two smooth; suture distinct; aperture semicircular, slightly oblique, unarmed; lip simple or modified by the last rib; umbilicus distinct. Length,  $\frac{2}{15}$  inch; breadth, nearly  $\frac{1}{10}$ . Hab. Portland.

**BULIMUS MARGINATUS** SAY.....vol. ii. p. 288, pl. lii. fig. 1.

*Cyclostoma marginata* SAY, (Binney's ed.) p. 22.

*Bulimus marginatus* PFEIFFER, Malac. Blatt. ii. 94.

*Bulimus fallax* GOULD, in Terr. Moll. l. c.

STIMPSON, Shells of N. E. p. 84, (absq. desc.)

*Pupa fallax* SAY, (Binney's ed.) p. 28.

PFEIFFER, l. c. iii. 533.

CHEMNITZ, ed. Nov. (1844,) p. 58, pl. 12, figs. 20, 21.

*Pupa Parraiana* ORBIGNY, Moll. Cuba, p. 181, pl. xii. figs. 9–11, (1853).

I have retained the first specific name given by Say, at the suggestion of Pfeiffer, (Malak. Blatt. 1856, ii. p. 13, in the review of Terr. Moll.), who justly observes that if the species is referred to *Bulimus*, no name has the priority over it, as *B. marginatus* Pf. is now considered a synonym of *B. Guillianii*, Petit.

As for the name *albilabris*, it was suggested by Adams only because *marginatus* was preoccupied.

Gould (Invert. 192) considers *Pupa placida* Say as a synonym of this species; and Pfeiffer (ii. 309) makes it var.  $\beta$  of *marginatus*.



## SPURIOUS, EXTRALIMITAL, &amp;c.

*Bulimus acicula* Müller, and *Bulimus octona* Brug. have been found in greenhouses and gardens, where they have been introduced on plants.

*B. exiguus* Binn. is the same as *Carychium exiguum*.

*B. fasciatus* Binn. is the same as *Achatina fasciata*.

*B. Gossei* Pf., vid. *Macroceramus pontificus*.

*B. Kieneri* Pf., vid. *Macroceramus pontificus*.

*B. lubricus* Ad. &c. is the same as *Achatina lubrica*.

*B. obscurus* Dr., vid. *Pupa placida* Say.

*B. striatus* Brug. is the same as *Glandina truncata*.

*B. vexillum* Brug. is the same as *Achatina fasciata*.

*B. zebra* Orb. is the same as *Achatina fasciata*.

*B. vermetus* Anthony. Of this species I can give no information other than that furnished by the original description given below.

**BULIMUS VERMETUS ANTHONY.** (Cover of Haldeman's Monograph No. 3, July, 1841.) Shell turriculated, livid brown; whorls 5, striated longitudinally; suture deeply indented; apex entire; body whorl a little more than equal to the spire; spire  $2\frac{1}{2}$  times the length of the aperture; length 3, width  $1\frac{1}{2}$  lines; aperture obliquely ovate; length of the aperture equal to the width of the body whorl. Ohio, near Cincinnati.

Distinguished by its peculiar mouth, which is curved in a regular curve from right to left, contracted at the upper angle, and spreading below; the whorls are also very deeply indented, and twisted as they are in *Succinea vermeta*.

## GENUS MACROCERAMUS GUILDING.

This genus is not accepted by Pfeiffer, who places its species under *Bulimus*.

**MACROCERAMUS PONTIFICUS** GOULD...vol. ii. p. 306, pl. lxix. fig. 1.

Pfeiffer refers this species to his *Bulimus Kieneri*, (Mon. iii. 365,) while Poey quotes it from Cuba, (Mem. i. 395,) as a synonym of *Bulimus Gossei* Pfr.

## GENUS ACHATINA LAMARCK.

**ACHATINA FASCIATA** MÜLLER.....vol. ii. p. 266, pl. lv. lvi. lvii.*Achatina solida* SAY, (Binney's ed.) p. 29.

DEKAY, N. Y. Moll. 56.

PFEIFFER, Mon. Hel. Viv. ii. 246.

*Achatina fasciata* ζ PFEIFFER, l. c. iii. 479.*Agatina variegata* RAFINESQUE, vid. vol. i. 50.*Bulimus fasciatus* BINNEY, l. c.

Say's original specimen of *Achatina solida* is still preserved in the Philadelphia Academy.

This is not *vexillum* DeKay, which see.

The lower figure of pl. 56, is *Achatina picta*, considered distinct by Reeve and Pfeiffer, (vid. Mon. iii. 490.) Other West Indian varieties than those figured are from time to time received from Florida.

**ACHATINA LUBRICA** MÜLLER.....vol. ii. p. 283, pl. lii. fig. 4.*Bulimus lubricus* SAY, (Binney's ed.) p. 31.

DEKAY, N. Y. Moll. p. 55, pl. iii. fig. 43.

*Bulimus lubricoides* STIMPSON, Shells of N. E. p. 54, (absq. descr.)

Stimpson, as will be seen by the synonymy, considers this distinct from the European shell.

## SPURIOUS SPECIES.

*Achatina virginea* is quoted from Florida by Jay, (Cat. 1835). It is also given by DeKay under the name of *Bulimus vexillum*, (N. Y. Moll. 56, pl. iv. fig. 56).

*A. bullata* Pf. is the same as *Glandina bullata*.

*A. flammigera*, Fer. pl. 118, f. 5-7, quoted by DeKay, p. 56, as inhabiting Florida, is not a native of the United States, and could not have come from there. He probably gives the species on the authority of Say, who mentions (Binn. ed. 29) finding it there.

*A. flammigera* Say is the same as *Bulimus zebra*.

*A. gracillima* Pf. is the same as *Bulimus gracillimus*.

*A. pellucida* Pf. olim, Binn. is the same as *Blauneria pellucida*.

*A. rosea* Desh. is the same as *Glandina truncata*.

*A. striata* DeK. &c. is the same as *Gl. truncata*? He refers to Fer. pl. 136, figs. 8-10, which is *A. rosea*, and not an inhabitant of Florida, from whence DeKay quotes his species.

*A. subula* Pf. is the same as *Bulimus subula*.

*A. Texasiana* Pf. is the same as *Glandina Texasiana*.

*A. truncata* Pf. &c. is the same as *Glandina truncata*.

*A. Vanuxemensis* Pf. &c., is the same as *Glandina Vanuxemensis*.

#### GENUS GLANDINA SCHUMACHER.

**GLANDINA BULLATA** GOULD.....vol. ii. p. 298, pl. lxii. a.

*Achatina bullata* PFEIFFER, Mon. Hel. Viv. iii. 512.

*Oleacina bullata* GRAY and PFEIFFER, Brit. Mus. Cat. Pulm. 24.

#### GLANDINA CORNEOLA.

##### PLATE LXI. FIGURE 1.

Testa conico-oblonga, tenuis, nitens, cornea; anfr. 7 ad 8, convexi, tenuissimè et longitudinaliter striati, et lineis minutis creberrimis volventibus notati; sutura crenulata; apertura oblonga, partem testæ dimidiam æquans; columella contorta, truncata, callo induta.

##### SYNONYMS AND REFERENCES.

*Glandina truncata* var. BINNEY, vol. ii. p. 302.

*Glandina corneola* W. G. BINNEY, Proc. Phila. Acad. 1857, p. 189; Notes, p. 9.

##### DESCRIPTION.

*Animal* not observed.

*Shell* oblong-conic, thin, shining, horn-color; whorls 7 to 8, longitudinally striate, and covered with numerous minute revolving lines; suture slightly crenulated; aperture oblong, half as long as the shell; columella curved, truncated, covered with light callus.

Length, 50; diameter, 18 millimetres.

*Geographical Distribution.* Western Texas (Redfield), Mexico (Smithsonian Collection).

*Remarks.* This shell, very rare in collections, is distinguished by its light horn-color, thin shell, and revolving

lines. It is the most distinctly marked species of the genus found in America.

### GLANDINA PARALLELA.

PLATE LXII. FIGURE 2.

Testa solida, albida, nitens, cylindraceo-elongata, striis creberrimis longitudinalibus notata; spira elevato-obtusa; anfr. 5 ad 6, superi convexi, ultimus lateribus rectis, æquis intervallis inter se distantibus, apertura angusta, partem testæ 3-7 æquans; labrum flexuosum, in medio rectum, margine basali curvatum; columella recta, truncata, callo induta.

#### SYNONYMS AND REFERENCES.

*Glandina truncata* var. BINNEY, l. c.

*Glandina parallela* W. G. BINNEY, Phila. Proc. 1857, p. 189; Notes, p. 9.

#### DESCRIPTION.

*Animal* not observed.

*Shell* heavy, shining, white, elongated, cylindrical; spire elevated, obtuse; whorls 6 to 7, with numerous, delicate, longitudinal striæ, the upper ones convex, the last one with straight parallel sides; lip straight along the middle, and parallel to the rectilinear side of the opposite whorl, at the basal extremity curved; columella straight, truncated, covered with a heavy callus.

Length, 56; breadth, 20 millimetres.

*Geographical Distribution.* Louisiana (Rev. E. R. Beadle).

*Remarks.* Distinguished by its peculiar parallel sides and heavy texture from any other described species.

### GLANDINA TEXASIANA PFEIFFER.

PLATE LXI. FIGURE 2.

T. oblonga, solidula, longitudinaliter confertim striata, nitida, pellucida, carnea; spira convexo-conica, obtusa; sutura pallida, minutè denticulata; anfr. 6 convexiusculi, ultimus spirâ paulo longior, basi parum attenuatus; columella perarcuata, basi laminam albam, tortam, abruptè truncatam



formans; apertura vix obliqua, acuminato-ovalis; perist. simplex, obtusum. Long. 29; diam.  $10\frac{1}{2}$  mill. Ap. mill. 16 longa,  $5\frac{1}{2}$  lata.

Habitat Texas. (Pf.)

#### SYNONYMS AND REFERENCES.

*Glandina truncata* var. BINNEY, l. c.

*Achatina Texasiana* PFEIFFER, Novit. Conch. 8, p. 82, pl. xxii. figs. 11, 12, (1857); Proc. Zool. Soc. 1856.

*Remarks.* This well characterized species was considered as a variety of *Glandina truncata* by Binney. It appears to be a common species. A variety is figured by me on pl. 77, fig. 21.

**GLANDINA TRUNCATA** GMELIN....vol. ii. p. 301, pl. lix. lx. lxxx, fig. 9.

*Achatina striata* CHEMNITZ, ed. 2, tab. 3, figs. 3, 4.

*Achatina truncata* CHEMNITZ, l. c. Bul. tab. xxxviii. figs. 21, 22; *Achatina*, No. 78.

PFEIFFER, l. c. (nec *Glandina*,) iii. 512.

*Glandina truncata* SAY, (Binney's ed.) p. 34, pl. xx.

DEKAY, N. Y. Moll. 56.

MRS. GRAY, Fig. Moll. An. pl. 301, fig. 5. (Ex Bost. Journ.)

BINNEY, l. c. excl. var. et pl. lxi. lxii.

*Oleacina truncata* GRAY and PFEIFFER, Brit. Mus. Pulmonata, p. 23.

*Planorbis glans* DEKAY, l. c. p. 56.

One of the most singular varieties of this variable species is figured on pl. 80. It came from Florida.

The varieties figured by Binney have been described as distinct species in the preceding articles.

Orbigny gives Cuba as its habitat, but Pfeiffer and Poey doubt its existence there.

For anatomy vid. Wyman in Boston Proc. i. 154.

**GLANDINA VANUXEMENSIS** LEA.....vol. ii. p. 299, pl. lxii. fig. 1.

*Achatina Vanuxemensis* PFEIFFER, l. c. iii. 518.

*Oleacina Vanuxemensis* GRAY and PFEIFFER, Brit. Mus. Cat. Pulm. p. 36.

#### GENUS PUPA DRAPANAUD.

**PUPA INCANA** BINNEY.....vol. ii. p. 316, pl. lxviii.; pl. lxxix. fig. 17.

*Pupa incana* PFEIFFER, Mal. Blatt. ii. p. 13.

*Pupa detrita* SHUTTLEWORTH, Bern. Mitth.

PFEIFFER, Malak. Bl. i. 158, (1853); i. 205, (1854,) pl. iii. figs. 9, 10.

*Pupa maritima* GOULD, l. c.

γ PFEIFFER, Mon. iii. 539.

In 1851, this species was only designated by name in vol. i.; the full description was given in vol. ii., the name being changed by Gould to *P. maritima*. Shuttleworth's description of *detrita* has not priority over the name I have retained. In the third volume of the Monograph, Pfeiffer considers it a variety of *maritima*, but later, having received from me some specimens, he remarks on them that they are similar to the Cuba *detrita*, but must take the name of *incana*. He also says that the true *maritima* has not as yet been found in Florida.

Young specimens are furnished with several tooth-like processes within the aperture, one being on the columellar, one on the parietal wall, and a third on the base of the aperture, removed somewhat within.

The variety figured on pl. 79, fig. 17, is from Key Biscayne, Fla.

**PUPA MODICA** GOULD,.....vol. ii. 319, pl. lii. fig. 2.

*Pupa modica* PFEIFFER, Mon. Hel. Viv. iii. 533.

**PUPA ARMIFERA** SAY.....vol. ii. p. 320, pl. lxx. fig. 4.

*Pupa armifera* SAY, (Carychium ?) Binney's ed. p. 21.

PFEIFFER, l. c. iii. 557.

CHEMNITZ, ed. 2, p. 57, pl. vii. figs. 17-19.

*Pupa rupicola* PFEIFFER, Symb. ii. 55, teste Pfr. l. c.

Say's original specimen is still preserved in the Philadelphia Academy. He appears to have considered it a *Carychium*.

**PUPA BADIA** ADAMS.....vol. ii. p. 323, pl. lxx. fig. 3.

*Pupa badia* DEKAY, N. Y. Moll. p. 49, pl. iv. fig. 45.

CHEMNITZ, ed. 2. p. 117, pl. xv. figs. 25-29.

*Pupa muscorum*, pars, PFEIFFER, Mon. Hel. Viv. ii. 312.

FORBES and HANLEY, Brit. Moll. iv. 97.

It will be noticed that the wood-cut does not show the basal tooth, as does the plate referred to. Its presence seems exceptional.

Adams (l. c.) compares it with *Pupa marginata* Dr., while the above authorities consider it identical with *P. muscorum* of Europe.

**PUPA CONTRACTA SAY**.....vol. ii. p. 324, pl. lxx. fig. 2.

*Pupa contracta* SAY, (Carychium,) Binney's ed. p. 25.

PFEIFFER, l. c. iii. 556.

*Pupa corticaria* PFEIFFER, Symb. ii. p. 54, (an. var.  $\beta$ ? Pfr. l. c.)

*Pupa deltostoma* CHARPENTIER, in Chemnitz, ed. 2, p. 181, pl. 21, figs. 17-19.

*Vertigo contracta* ADAMS, Gen. ii. 172, absq. descr.

The figure of Küster is more like *armifera*. His description is of *contracta*.

*Pupa deltostoma* is evidently this species. The description is as follows :—

T. latè profundèque rimata, ovato-conoidea, nitidula, glabriuscula, alba; spira convexo-conica, obtusa; anfr. 5 convexis, ultimo basi rotundato, antice calloso; apertura trigona, quadriplicata, pl. 1 lamelliformi in pariete aperturali, 1 in columella, 2 in palato, peristomate undique expanso, marginibus conjunctis. Tennessee.

**PUPA DECORA GOULD**.....vol. ii. p. 327, pl. lxxi. fig. 2.

*Pupa decora* PFEIFFER, Mon. Hel. Viv. iii. 555.

*Vertigo decora* ADAMS, Gen. Rec. Moll. ii. 172, (absq. desc.)

**PUPA PENTODON SAY**.....vol. ii. p. 328, pl. lxii. fig. 1.

*Vertigo pentodon* SAY (Binney's ed.) p. 27.

*Pupa pentodon* CHEMNITZ, ed. 2, p. 125, pl. xvi. figs. 24-26.

PFEIFFER, l. c. iii. 557.

*Pupa curvidens* PFEIFFER, l. c. ii.

In the second volume of the Monograph, Pfeiffer places both *Tappaniana* and *curvidens* in the synonymy. De Kay's figure shows no tooth. Say's type is still preserved in the Philadelphia Academy. Adams's description is as follows :—

**PUPA TAPPANIANA** Ward, MSS. *P. testa minima, pellucida, subconica, perforata; anfractibus quinque; apertura suborbiculari, 8-dentata: dente uno columellari, majore, quatuor alteris magnis, tribus alteris parvis.*

*Shell* very small, pale horn-color, translucent, tapering above the penultimate whorl; whorls a little more than five, convex, with a well impressed suture; aperture sub-orbicular, (the penult whorl cutting off about one third of the circle,) about one third of the length of the shell; margin sharp, with a narrow contraction in the sub-margin, beneath which is a thickening within, on which are the labial teeth; teeth eight, five primary and three secondary; of the former the largest is on the penultimate whorl, the next largest on the left side of the aperture; at the base, beginning at the left hand, is a primary, then a secondary, a primary, a secondary, a primary, and another secondary, extending nearly to the upper extremity of the right margin: the last three primaries are not constant in size; umbilicus open.

Length, .08 inch; breadth, .05 inch.

Cabinets of Middlebury College and my own.

*Geographical Distribution.* This shell has been found in Ohio, in Massachusetts, near Boston, and in this place.

*Remarks.* This species was discovered by the late Dr. Ward of Roscoe, Ohio, from whom I received specimens in April, 1840, with the above name. This I retain in justice to Dr. W., who was alike eminent for his attainments and liberality, and in whose sudden death science sustained a severe loss. Subsequently the species was found in Cambridge, Mass., by my friend T. J. Whittemore, Esq., and Dr. Gould. Among some minute shells collected in this town by Mr. M. W. Johnson, of the graduating class of last summer, I have detected this species, but too late for insertion in an article, on the Mollusca of this vicinity, in the next number of the *American Journal of Science and Arts*, and have therefore published this description separately.

#### **PUPA PLACIDA SAY.**

*Shell* dextral, cylindric-conic, pale yellowish horn-color; apex whitish, obtuse; whorls six and a half, somewhat wrinkled; suture moderately impressed; aperture unarmed, longitudinally oval, truncate a little obliquely above by the penultimate volution; columella so recurved as almost to conceal the umbilicus; labrum, with the exception of the superior portion, appearing a little recurved



when viewed in front, but when viewed in profile, this recurvature is hardly perceptible; umbilicus very narrow.

Length over three tenths of an inch. Inhabits Massachusetts.

For this shell I am indebted to Dr. T. W. Harris, of Milton, from whom I have received many interesting species of our more northern regions. At first view it might be mistaken for the *P. marginata* Nob., but it is quadruple the size, and the labrum is not reflected and thickened.

## SYNONYMS AND REFERENCES.

*Pupa placida* SAY, (Binney's ed.) p. 39.

*Pupa fallax* DEKAY, N. Y. Moll. p. 51.

GOULD, Invert. 192.

*Pupa fallax*  $\beta$  PFEIFFER, Mon. Hel. Viv. ii. 309.

*Bulinus hordeanus*? DEKAY, l. c.

*Bulinus obscurus* GOULD, Mon. Pupa, p. 17.

PFEIFFER, iii. 350, on DEKAY's authority.

*Remarks.* This will probably always remain a doubtful species, since those having the best means of deciding upon it have not been able to agree. I therefore simply give Say's original description.

**PUPA RUPICOLA** SAY.....vol. ii. p. 341, pl. lxx. fig. 1.

*Carychium*? *rupicola* SAY (Binney's ed.) p. 22.

*Pupa rupicola* CHEMNITZ, ed. 2, p. 123, pl. xvi. figs. 17-19.

DEKAY, N. Y. Moll. p. 52.

PFEIFFER, l. c. iii. 557; nec Symb. ii. 55.

*Pupa procera* CHEMNITZ, p. 58, pl. vii. figs. 20, 21.

PFEIFFER, l. c. ii. 360.

*Pupa carinata* GOULD, 1842, Boston Journ. iv. 1, cover, p. 3.

PFEIFFER, l. c. ii. 359; iii. 557.

*Pupa gibbosa* CHEMNITZ, ed. 2, p. 123, pl. xvi. figs. 13-16.

*Pupa minuta* (SAY) PFEIFFER, l. c. ii. 356; iii. 555; Symb. ii. 54.

*Vertigo rupicola* BINNEY, l. c.

*minuta*? ADAMS, Gen. ii. 172, absq. descr.

*Pupa procera* is said to be identical with *rupicola* by Binney (Boston Proc. i. 105). Gould doubts the correctness of this decision (p. 106). DeKay confirms it, as does Pfeiffer in vol. iii. of his Monograph.

*Pupa carinata* Gould was subsequently referred by him to *P. procera* (l. c. iv. 3, p. 359); Pfeiffer retains it, not having, however, seen the shell. Binney (Boston Proc. i. 105) considers it a doubtful species. No mention of it is made in the Terrestrial Mollusks.

Say never described any species of *Pupa* under the names of *gibbosa* or *minuta* which are ascribed to him. Pfeiffer considers the two identical. Röemer quotes *minuta* from Texas. On pl. 78, fig. 17, will be found a facsimile of the figure of *gibbosa* from Chemnitz. Pfeiffer's description of *minuta* is as follows. From the two I should consider the species identical with *rupicola*.

PUPA MINUTA. T. vix rimata, cylindrica, nitida, pellucida, cornea; spira apice obtusa; anfr. 6 convexiusculi, ultimus basi subcompressus; apertura subsemicircularis, 4-dentata; dentibus subæqualibus, 1 parietali, 1 columellari, 2 palatalibus; perist. expansum, sublabiatum, marginibus disjunctis, dextro supernè arcuato. Long.  $2\frac{2}{3}$ , diam.  $1\frac{1}{4}$  mill. Ap. oblique  $\frac{3}{4}$  mill. longa. Habitat in Pennsylvania.

Obs. An forte varietas *P. procera*?

I suppose *Vertigo minuta* of Adams's Genera to be this species.

It is also placed in the subgenus *Vertigo* by Binney, though the animal had not been seen.

**PUPA VARIOLOSA** GOULD..... vol. ii. 343, pl. lxxii. fig. 3.

*Pupa variolosa* PFEIFFER, Mon. Hel. Viv. iii. 556.

*Vertigo variolosa* ADAMS, Gen. ii. 172.

**PUPA CORTICARIA** SAY..... vol. ii. p. 339, pl. lxxii. fig. 4.

*Odostomia corticaria* SAY (Binney's ed.) p. 7, pl. lxxii. fig. 5.

*Pupa corticaria* PFEIFFER, l. c. iii. 542.

CHEMNITZ, l. c. p. 97.

*Carychium corticaria* FERUSSAC, Podr. No. 3, (absq. desc.)

Pfeiffer (Mon. ii.) says that the *corticaria* of the Symbolæ is *P. contracta*.

Binney places the species among the *Vertigines*, though it is described as having four tentacles.

Ferussac, l. c., considered it a *Carychium*.

Say's type is still preserved in the collection of the Philadelphia Academy.

#### PUPA PELLUCIDA PFEIFFER.

T. subperforata, cylindracea, tenuis, pellucida, nitida, pallidè flavida; spira parum attenuata, apice obtusa; anfr. 5 convexi, ultimus præcedente planior; apertura semiovalis, 5-dentata: dentibus singulis validis in pariete aperturali et columella, 2 mediocribus in margine dextro, quinto minimo in basi palati; perist. simplex, margine dextro expanso, columellari reflexo. Long. 2; diam. vix 1 mill. Ap. vix  $\frac{3}{4}$  mill. longa. (Pfeiffer Mon. Hel. Viv. ii. 360.)

This is Pfeiffer's description of a Cuban species quoted from Texas by Röemer (p. 456.)

#### PUPA HOPPII MÖLLER.

##### PLATE LXXVIII. FIGURE 2.

Testa dextrorsa, cylindracea, obtusa, lævi; columella bidentata. Long. 1, 2 $\frac{1}{4}$ , R. (Möller.)

##### SYNONYMS AND REFERENCES.

*Pupa Hoppü* MÖLLER, Ind. Moll. Gröenl. p. 4, (1842.)

TROSCHER, Ar. f. Nat. 1843, ii. 126.

CHEMNITZ, ed. 2, pl. xix. figs. 29, 30.

PFEIFFER, Mon. Hel. Viv. ii. 328; iii. 536.

*Pupa Steenbuchii* BECK, (1847,) teste MÖRCH, Nat. Bidr. of Gröenl. p. 75.

*Remarks.* I have seen no specimen of this Greenland shell. The figure I have given is a fac-simile of one of those in Chemnitz, ed. 2.

##### SPURIOUS SPECIES.

*Pupa albilabris* Ad. is the same as *Bul. marginatus*.

*P. costulata* Mighels is the same as *Bul. harpa*.

*P. exigua* Say, &c. is the same as *Carychium exiguum*.

*P. fallax* Say, &c. is the same as *Bul. marginatus*.

- P. Gouldii* Binn. &c. is the same as *Vertigo Gouldii*.  
*P. milium* Gld. is the same as *Vertigo milium*.  
*P. modesta* Say &c. is the same as *Vertigo ovata*.  
*P. ovata* Gld. &c. is the same as *Vertigo ovata*.  
*P. ovulum* Pf. is the same as *Vertigo ovata*.  
*P. Parraiana* Orb. is the same as *Bul. marginatus*.  
*P. simplex* Gld. &c. is the same as *Vertigo simplex*.  
*P. unicarinata* Bin., vol. i., is the same as *Macroceramus pontificus*.

## SUBGENUS VERTIGO.

Stimpson, 1851, *Shells of N. E.*, p. 53, separates this group from the *Helicidæ*, considering the want of lower tentacles sufficient to form a family of *Vertiginidæ*.

**VERTIGO GOULDII** BINNEY .....vol. ii. p. 333, pl. lxxi. fig. 2.

*Vertigo Gouldii* STIMPSON, *Shells of N. E.*, p. 53, absq. desc..

*Pupa Gouldii* CHEMNITZ, ed. 2, p. 124, pl. xvi. figs. 20-23.\*

PFEIFFER, l. c. iii. 557.

**VERTIGO MILIUM** GOULD .....vol. ii. p. 337, pl. lxxi. fig. 1.

*Pupa milium* PFEIFFER, l. c. iii. 559.

CHEMNITZ, ed. 2, p. 119, pl. xv. figs. 39-42.

**VERTIGO OVATA** SAY ..... vol. ii. p. 334, pl. lxxi. fig. 4.

*Vertigo ovata* SAY, (Binney's ed.) p. 26.

*Pupa ovata* CHEMNITZ, ed. 2, p. 118, pl. xiv. figs. 1, 2; xv. figs. 35-38.

PFEIFFER, *Mon. Hel. Viv.* ii. 360; iii. 558; *Symb.* ii. 54.

*Pupa modesta* SAY, (Binney's ed.) p. 32, pl. 74, fig. 5.

*Pupa ovulum* PFEIFFER, olim, *Symb.* i. 46.

Adams (l. c.) considers these two species distinct.

Found also in Mexico and Cuba, (Pfeiffer.)

**VERTIGO SIMPLEX** GOULD .....vol. ii. p. 343, pl. lxxii. fig. 3.

*Vertigo simplex* STIMPSON, *Shells of N. E.* p. 53, (absq. desc.)

*Pupa simplex* PFEIFFER, l. c. iii. 530.

\* "In the States of New York, Baltimore, Cambridge."



## SPURIOUS SPECIES.

*V. contracta* Ad. Gen. Rec. Moll. is the same as Pupa contracta.

*V. decora* Ad. Gen. Rec. Moll. is the same as Pupa decora.

*V. minuta* Ad. Gen. Rec. Moll. is the same as Pupa rupicola.

*V. pentodon* Say is the same as Pupa pentodon.

*V. rupicola* Binney is the same as Pupa rupicola.

## GENUS CYLINDRELLA PFEIFFER.

## CYLINDRELLA VARIEGATA PFEIFFER.

This species was described by Pfeiffer before *C. lactaria* Gould was published. Their identity is well established. I have not received any specimens of the true *variegata* from Florida, or any other portions of the United States. Pfeiffer (Mal. Blatt. i. 211) gives Florida as its habitat, probably on the authority of Gould's description in the Terrestrial Mollusks. At that time the figure had not been published.

Specimens of *lactaria* Gould, received from himself and also from Poey, agree perfectly with the text (p. 309), but are not the shell figured (pl. 69, fig. 2). Neither do they agree with the Florida shell. Having sent specimens of the shell found in Florida to Poey, he returned them labelled *C. Poeyana* Orb., and sent me Cuban specimens of the same species.

It follows, therefore, that the shell figured (pl. 69, fig. 2) is not described in the text, where reference is erroneously made to it under *C. lactaria* Gould, which is *C. variegata* Pfr. It will be noticed that no reference to geographical distribution is made by Gould. The shell figured is described in the following article.

## CYLINDRELLA POEYANA ORBIGNY.

## PLATE LXIX. FIGURE 2.

T. elongatissima, fusioidea, tenuis, cornea, longitudinaliter acuto-striata; spira elongatissima, inflata, posticè acuminata, truncata; anfr. 11 convexiusculi, ultimus anticè carinatus; apertura rotundata; perist. continuum, acutum. Long. 14, diam. 13 mill. (Orbigny.)

## SYNONYMS AND REFERENCES.

*Pupa Poeyana* ORBIGNY, Moll. Cuba, i. 185, pl. xii. figs. 24-26.

*Cylindrella Poeyana* PFEIFFER, Mon. Hel. Viv. ii. 380; iii. 572.

POEY Memorias, ii. pl. xii. fig. 10.

*Cylindrella lactaria* BINNEY, l. c. in tab. non in textu.

*Remarks.* This is the shell figured under the name of *lactaria* Gould, as remarked in the preceding article. I will here add that this species may readily be distinguished from *lactaria* by having much rougher striæ, and by being entirely free from the "longitudinal, flexuose, milk-white lines" which are the principal characteristic of that species, and from which, indeed, its name is derived.

Found in large quantities in Florida; also in Cuba.

**CYLINDRELLA JEJUNA** GOULD. . . . . vol. ii. p. 310, pl. lxix. fig. 3.

*Cylindrella jejuna* PFEIFFER, Mon. Hel. Viv. iii. 573.

*Cylindrella variegata* PFEIFFER, Mal. Bl. ii. 13.

Pfeiffer, in repeating Gould's description, not having seen the shell, suggests its being a variety of *C. lactaria*. Later (Mal. Blatt. ii. 13) he considers it a synonym of that species, which he refers to his *variegata*.

**CYLINDRELLA ROEMERI** PFEIFFER.

T. vix rimata, subcylindræa, apice obtuse conica, non truncata, substriata, carneo-albida; anfr. 14 angusti, planiusculi, ultimus basi carinatus, antrorsum solutus et extrorsum tortus; apertura verticalis, oblongo-circularis, intus plica marginis dextræ coarctata: perist. continuum, undique breviter expansum. Long. 13-14, diam.  $4\frac{1}{2}$  mill. Ap. 3 mill. longa,  $2\frac{1}{2}$  lata.

β. Minor, sursum ventrosior, anfr. 12, ultimo brevius soluto; long. 11, diam. supra medium 4 mill.

## SYNONYMS AND REFERENCES.

*Cylindrella Römeri* PFEIFFER, Mon. Hel. Viv. ii. 383; iii. 579; in Römer's Texas, p. 456.

*Remarks.* I have not seen this shell, which was found by Römer at New Brauenfels, Texas. I have given the original description above, and add an observation from the same source:—

Affinis quidem et præcedenti (*C. Piloceri* Pfr.) et sequenti (*C. Goldfussi* Mke.), tamen carinâ basalo anfractus ultimi et ejus torsione tam singulari, ut testam primo aspectu sinistrorsem putes, ab omnibus distinctissimo.

### CYLINDRELLA GOLDFUSSI PFEIFFER.

PLATE LXXIX. FIGURE 33.

*C.* testa elliptico-oblonga, subeylindræa, apice conica, integra, acuta; umbilicata, luteo-cornea, tenui, pellucida; anfractibus undecim, convexiusculis, dense et tenuissime arcuatim costulatis: infimo parum protracto, basi rotundato, compressiusculo; apertura patente orbiculato-subcordata; canaliculo brevissimo, obtuso. (Pfr.)

#### SYNONYMS AND REFERENCES.

*Cylindrella Goldfussi* MENKE, in Zeitsch. f. Mal. 1847, p. 2.

PFEIFFER, Mon. Hel. Viv. ii. 383; iii. 579.

PHILIPPI, Icon. iii. 17, p. 6, tab. iii. fig. 9.

#### DESCRIPTION.

*Animal* not observed.

*Shell* umbilicated, elongated, more ventricose at the middle, apex conic, not truncated, thin, diaphanous, light horn-color, marked with numerous light subarcuate striæ; whorls 12, scarcely convex, narrow, the last slightly extended beyond the body of the shell, carinated, its right side somewhat furrowed, rounded at base; aperture subvertical, obliquely and subtriangularly pear-shaped; perist. slightly expanded at its entire circumference, its right termination flexuose.

Length, 11; diameter,  $4\frac{1}{3}$  mill.

*Geographical Distribution.* Texas, (Pfeiffer.)

*Remarks.* The figure (somewhat magnified) is drawn from a specimen from Mr. Bland's collection.

In general form, it is more nearly allied to *Macroceramus pontificus* than any other figured in the "Mollusks."

#### SPURIOUS SPECIES.

*Cylindrella pontifica* Gould (p. 306) is *Macroceramus pontificus*, vid. p. 137.

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This concludes the list of known American Helicidæ. The following genera and species have been described by Rafinesque, but are all included in the genus *Helix* :—

<i>Aplodon</i> Raf.	<i>Stenostoma</i> Raf.
<i>Aplodon nodosum</i> Raf.	<i>Stenotrema</i> Raf.
<i>Chimotrema</i> Raf.	<i>Stenotrema convexa</i> Raf.
<i>Chimotrema planiuscula</i> Raf.	<i>Toxostoma</i> Raf.
<i>Hemiloma</i> Raf.	<i>Toxostoma globularis</i> Raf.
<i>Hemiloma avara</i> Raf.	<i>Toxotrema</i> Raf.
<i>Mesodon</i> Raf.	<i>Toxotrema globularis</i> Raf.
<i>Mesodon maculatum</i> Raf.	<i>Toxotrema complanata</i> Raf.
<i>Mesomphix</i> Raf.	<i>Triodopsis</i> Raf.
<i>Odomphium</i> Raf.	<i>Triodopsis lunula</i> Raf.
<i>Odotropis</i> Raf.	<i>Trophodon</i> Raf.
<i>Omphalina</i> Raf.	<i>Xolotrema</i> Raf.
<i>Omphalina cuprea</i> Raf. ; vide	<i>Xolotrema lunula</i> Raf.
<i>Helix fuliginosa</i> .	<i>Xolotrema triodopsis</i> Raf.

On vol. i., p. 48 et seq. will be found a reprint and translation of Rafinesque's descriptions. The following, omitted by Binney, will make the series complete :—

*Aplodon nodosum*. Trois tours de spire bosselés, légèrement ridés concentriquement en dessous.

The genus *Trophodon* differs from *Mesodon* by upper lip notched. The genus *Odomphium*, by having an umbilic.

*Toxostoma globularis*. Globular, smooth ; 5 spires. In Kentucky.

*Partula Otaheitana* Fer., as observed in vol. i. p. 159, never existed in the United States.

## FAMILY AURICULACEA.

Dr. Binney, in his work on the Terrestrial Mollusks of this country, mentions that there is much reason to doubt whether this family is truly Pneumo-branchiate. Considering its species to be, at all events, aquatic, he does not include them in his work.



More recent investigations have shown that they respire free air, and that they are amphibious rather than aquatic. The systematic arrangement of this family may be seen in the following tables, as proposed by Dr. Pfeiffer and H. and A. Adams. The arrangement adopted in the following pages corresponds with that of the former. I do not propose to refer to the many systems of other foreign authors, but shall notice those proposed by Americans.

By this table it will appear that Pfeiffer divides the air-breathing Mollusks in two grand divisions; A, including those furnished with four tentacles, and B, including those with two only. The latter are also subdivided into *a*, those not operculated, and *b*, those furnished with an operculum. In the former of these subdivisions, he places the family *Auriculacea*.

In the "Genera of Recent Mollusca," the air-breathing Gasteropods are divided into Inoperculate and Operculate. The former are subdivided, according to their terrestrial, lacustrine, and marine habits, into Geophila, Limnophila, and Thassilophila. The second subdivision is composed of the *Auriculacea*, under the name of *Ellobiadae*, and the *Limnæidae*.

In both of these systems, the family is placed nearest to the fresh-water Pulmonates, with which they are more closely allied than with the land snails.

Dr. Pfeiffer (Mon. Auric. Viv.) thus divides the

#### PULMONATA.

A. Tetracera,	{	a. Inoperculata, . . . . .	{	I. Onchidiacea.
				II. Limacea.
				III. Helicea.
				IV. Limnæacea.
B. Dicera,	{	b. Operculata,	{	V. Auriculacea.
				VI. Proserpinacea.
				VII. Aciculacea.
				VIII. Cyclostomacea.
		a. Terrestria, . . .	{	IX. Helicinacea.
				X. Amphibolacea.
		β. Aquatilia, . . .	{	XI. Ampullariacea.

In the "Genera of Recent Mollusca," by Henry and Arthur Adams, the following division is made of the air-breathing Gasteropods:—

## SUBCLASS PULMONIFERA.

ORDER.	SUBORDER.	FAMILY.
Inoperculata,	Geophila, . . . . .	Oleacinidæ.
		Testacellidæ.
		Helicidæ.
		Limnacidæ.
		Stenopidæ.
		Arionidæ.
Operculata,	Limnophila, . . . . .	Janellidæ.
		Veronicellidæ.
		Onchidiidæ.
		Ellobiidæ.
		Limnæidæ.
		Amphibolidæ.
		Siphonariidæ.
		Cyclophoridæ.
Operculata,	Ectophthalma, . . . . .	Helicinidæ.
		Truncatellidæ.
		Assiminidæ.

The family Ellobiidæ corresponds to Pfeiffer's family Auriculacea.

This family has been noticed only by the following American authors. The treatment of the various genera and species will be found in their respective synonymy.

In 1841 Gould placed the genus *Auricula* in the Lamarckian family *Colimacea*.

DeKay in 1843 places the *Auriculidæ* as the third family of *Pulmobranchia*. He unites all the species described in his Zoölogy of New York in the genus *Auricula*.

Stimpson in 1851 catalogues the family *Melampidæ*, comprising the genera *Melampus* and *Carychium*. He was the first American to remove *Carychium exiguum* from the genus *Pupa*.

The Auriculacea are easily distinguished from the other inoperculated land Mollusks. They are furnished with but one pair of non-retractile tentacles, on the inner base of which are situated the sessile eyes. The head is extended beyond the tentacles into an obtuse, rounded,

bilobed snout. The mantle is thin, thickened on its margin. The foot is elongated and pointed. The sexes are united in each individual.

The shell is spiral, extremely variable, and in the American species conic, generally with a flattened spire, and furnished with numerous tooth-like laminæ, which contract the narrow aperture.

The *Auriculidæ* are amphibious Mollusks, breathing free air, but apparently dependent for existence on a great deal of moisture, if not on the actual vicinity of the sea. Some species pass their whole life under circumstances which seem to preclude the possibility of their respiring air. Thus *Alexia myosotis* is often found on isolated stones in salt marshes, which are entirely covered by the tide four hours out of twelve. This species, when immersed in fresh water, becomes benumbed and soon dies.

*Carychium exiguum*, on the other hand, though found under similar circumstances, does not depend on salt water, being widely distributed far beyond its influence over the interior of the country. *Blauneria pellucida* also has been detected living far from any water in a garden in Washington, whither it was introduced on plants from Charleston, S. C. With the exception of the two last mentioned, the American species are found on salt marshes and in brackish water near the sea.

Of their geographical distribution but little is yet known. *Melampus bidentatus* is found from Maine to Florida. *Melampus obliquus* is referred by Say to South Carolina. *Alexia myosotis* was probably introduced from Europe, I have never known of its being found south of New York harbor. *Carychium exiguum* will probably be found in all the Middle and Northern States. The other species are confined to the coast of Florida and the Gulf of Mexico, some of them being common to Cuba and other West Indian Islands.

In order to make the following a complete monograph of American *Auriculacea*, I have copied from the Terrestrial Mollusks the entire description of the few species mentioned in that work.

So few persons are interested in this family of Mollusks, and the extent of our coast is so great, the following must be considered as a very imperfect attempt at a monograph of the American species of the family.

Pfeiffer subdivides the family into three subfamilies: — *Otinea*, *Melampea*, and *Auriculea*, respectively analogous to the *Ancylea*, a subfamily of *Limneacea*, — to the true *Limneacea*, and to the *Aciculacea*. The first subfamily is not represented in this country.

#### SUBFAMILY MELAMPEA.

This subfamily is distinguished by an acute, simple peristome. The aperture is generally armed with tooth-like laminæ. The animals of all our species are subaquatic, living in close proximity to salt or brackish water.

H. and A. Adams give the name of *Melampinæ* to this subdivision. In America it has been noticed as a family by Stimpson, (Shells of N. E.), who calls it *Melampidæ*, and includes one species and one genus which Pfeiffer refers to a separate subdivision of the family.

#### GENUS MELAMPUS MONTFORT.

The characteristics of this genus are the same as those already given for the subfamily.

It is an inhabitant of every quarter of the globe.

#### MELAMPUS BIDENTATUS SAY.

##### PLATE LXXV. FIGURE 23.

*T. imperforata*, elliptico-ovata, tenuiuscula, nitens, (aut corrosa,) lineis minutis transversis, et rugulis longitudinalibus notata; cornea, aut griseo-brunnea, interdum fasciis 4 rufis, angustis, cingulata; sutura distincta; spira brevis, obtusa; anfr. 6-7, superi planiusculi, ultimus  $\frac{2}{3}$  long. æquans,



obtusè subcarinatus; apertura subobliqua, angusta, ad basin expansior,  $\frac{5}{7}$  long. æquans; perist. simplex, acutum, tenue, intus inerme, aut denticulis albis, transversis, 1-7, marginem non attingentibus, in liras decurrentibus, interdum in callo longitudinali positus, armatum; paries aperturalis callo nitente induta, et dente unicâ, albâ, transversâ, in aperturam intrante armata; columella plicam unam, albam, ad basin excurrentem gerens; anfr. interni et axis absorpti.

## SYNONYMS AND REFERENCES.

- Melampus bidentatus* SAY, Journ. Acad. Nat. Sc. Phila. vol. ii. p. 245, July, 1822; Binney's ed. p. 84.  
 RUSSELL, Journ. Essex Co. Nat. Hist. Soc. vol. i. part 2, p. 67, anno 1839.  
 PFEIFFER, Mon. Auric. Viv. p. 45, (excl. Mel. borealis).  
 ADAMS, Genera, ii. p. 243, Sept. 1855, absq. desc.
- Melampus biplicatus* PFEIFFER, Mon. Auric. Viv. p. 21.
- Melampus corneus* STIMPSON, Shells of N. E. p. 51, (absq. desc.)  
 BECK, Ind. (absq. desc.)
- Melampus ? Jaumei* PFEIFFER, Mon. Auric. Viv. p. 25.
- Melampus lineatus* BECK, Ind. (absq. desc.) p. 107.
- Auricula cornea* DESHAYES, Encycl. Meth. ii. p. 90; ditto in Lam. ed. 2, viii. p. 339; ed. 3, vol. iii. p. 390, (1839).
- Auricula bidentata* GOULD, Inv. Mass. p. 197, fig. 130.  
 DEKAY, N. Y. Moll. p. 57, t. v. fig. 92, 1, 2, 3.  
 KÜSTER, Chemn. ed. 2, Auric. p. 41, pl. vi. figs. 7-11.  
 JAY, Cat. 264, (absq. desc.)
- Non *Auricula bidens* POTIEZ et MICHAUD, p. 201, pl. xx. figs. 9, 10.
- Auricula Jaumei* MITTRE, Rev. Zoöl. (Mars. 1841,) p. 66.
- Auricula biplicata* DESHAYES, Encycl. Meth. ii. p. 91.
- Conovulus biplicatus* BECK, Ind. 106, (absq. desc.)
- Melampus bidentatus* var. *lineatus* SAY, l. c.
- Melampus bidentatus* β. PFEIFFER, l. c. p. 46.  
 a. DEKAY, l. c.

## DESCRIPTION.

*Animal* about as long as the shell, and the foot is transversely bifid; tentacula somewhat wrinkled, cylindrical, rather smaller towards the tips, which are obtuse or rounded; eyes placed at the inner base of the tentacula; rostrum somewhat wrinkled, nearly as long as the tentacula, bilobate before; foot, anterior segment emarginate behind, posterior segment bifid at the extremity; all above, with the exception of the tentacula and rostrum, glabrous, reddish-brown, beneath paler. (Say.)

*Shell* imperforate, elliptically ovate, rather thin, shining when perfect, but usually found much eroded; the surface is marked with longitudinal wrinkles, and very minute revolving striæ; horn-color, or grayish-red, often with revolving, narrow, rufous bands, four or five in number; suture well marked; spire short, and usually obtuse, often somewhat eroded; whorls usually 6, the upper ones flattened, the body whorl equalling about  $\frac{5}{6}$  of the entire length of the shell, and obtusely angulated at its greatest width; aperture hardly oblique, very long and narrow, enlarging gradually towards the base, about  $\frac{5}{7}$  the length of the shell; peristome very thin and sharp, not reflected, on the interior furnished with no laminæ, or with from one to seven; these laminæ are elongated, white, and do not reach the margin; they are usually separate, placed at irregular intervals, but sometimes are found on a longitudinal elevated, white callus; they enter but a short distance into the aperture; the parietal wall of the aperture is covered with a thin, shining, enamel-like callus, and bears on its lower half a single, white, prominent and transverse tooth, entering into the aperture; the columellar is also furnished with a white, tooth-like fold, commencing at the termination of the sharp peristome, and revolving upwards into the interior of the shell; this fold does not extend far into the aperture, as all the internal whorls and axis of the shell are early absorbed by the animal.

Length of an unusually large individual 13, breadth 7 millimetres.

*Geographical Distribution.* I have this species from the vicinity of Boston, from New Jersey, and South Carolina. Say found it at the mouth of the St. John's River, in Florida, and in Maryland; Mittre gives Virginia; Pfeiffer, Georgia; DeKay, New York. Stimpson did not detect it farther North than Massachusetts Bay. It may, therefore, be said to range from that point southward along the

whole Atlantic coast. It has also been found in Texas, (Röemer.)

Gould mentions its being said to have been found living with a *Planorbis* at Windsor, Vt. If so, it must be adapted to a remarkable difference of station, being usually found near the sea. Pfeiffer also gives Vermont as the habitat, probably on the above authority.

*Remarks.* This shell is familiar to all those who have collected among the salt marshes of Massachusetts Bay. Around Boston it is found not far below high-water-mark, often crawling up the stems of grasses, as if to avoid the returning tide.

The shell when young is quite pretty, being shining and often variegated by the revolving bands. But few mature shells are met with in a perfect condition. They are usually much eroded. From the toothless outer lip to that bearing a heavy callus ridged with transverse laminæ, every intermediate variety is found. The absence of the laminæ is equally common in mature and young shells.

Authentic specimens of this species are still preserved in the collection of the Academy of Natural Sciences of Philadelphia.

The original descriptions of Mittre and Deshayes are given below. I have seen authentic specimens of neither of their shells. The descriptions are merely copied by Pfeiffer, in the works referred to in the synonymy.

Say designates by the name of *lineatus*, a form peculiar for its revolving lines or bands and more narrow base of the aperture, (vid. Binn. ed. p. 85.) I have met with none sufficiently marked to form a variety, much less a distinct species. The revolving lines are very commonly found on young specimens. DeKay mentions this as *var. a*, Pfeiffer as  $\beta$ . The latter author thus describes a *var. \gamma*.

Anfractu ultimo infra suturam subexcavato, minutè spiraliter

striato, labro pone limbum fuscum albo-callosa, regulariter 6-10 plicato. Georgia.

He quotes in the synonymy of this variety *Mel. borealis* Conr. of Cuming's collection. Conrad's species is much more likely to be *Alexia myosotis* than any variety of *Mel. bidentatus*.

Potiez and Michaud describe and figure quite a distinct shell under the name of *Auricula bidens* Say.

Stimpson gives precedence to Deshayes's name *corneus*. Say's name has eight years priority, and is not preoccupied in the genus *Melampus*. It was while treated as an *Auricula* that any question existed in regard to its specific name.

Pl. 75, fig. 23, represents a specimen not furnished with laminæ within the peristome.

The date of publication of this species is erroneously quoted by Pfeiffer as 1821. The title-page of the first part of vol. ii. of the Academy Proceedings bears this date. The description was actually published at the date given by me.

AURICULA JAUMEL. A. testa conoidea, lævi, corneo-lutescente, longitudinaliter substriata; spira brevi, obtusa, sæpe erosa; apertura elongata, angustissima; columella basi alba, biplicata, labro tenui, acuto, intus dentato atque sulcato.

Petite coquille mince, presque lisse, conoïde, d'une couleur jaunâtre cornée; chez les jeunes individus on voit des fascies brunes, transversales et régulièrement disposées. Sa spire est courte, obtuse, souvent érodée, comme chez la plupart des coquilles fluviatiles; l'ouverture est étroite, allongée; la columelle offre, vers sa base, deux dents blanches, égales et légèrement obliques; le bord droit, simple et tranchant, présente, à l'intérieur, une rangée de plis saillans, inégaux, séparés par des sillons d'autant plus marqués qu'ils sont plus inférieurs. Cette Auricule appartient à la section des Conovules; elle est voisine de l'*Auricula cornea* de Deshayes, dont elle diffère néanmoins par son bord droit constamment denté et sillonné. Elle a 3 à 4 lignes de longueur.

Elle habite les marais, aux environs de Hampton en Virginie, où elle



vit presque toujours dans l'eau; rarement la trouve-t-on montée sur les jones qui comblent les mares d'eau où ces Mollusques abondent. !

Dédiée à mon ami M. Jaume, chirurgien de la Marine, qui, pendant mon voyage sur le vaisseau l'Hercule, m'a accompagné et aidé dans mes recherches Zoologiques. (Mittre, l. c.)

**AURICULA CORNEA.** A. testâ ovato-coniformi, translucidâ, transversim substriatâ, corneo-griseâ, spirâ brevi, obtusâ, sæpe erosâ; aperturâ angustâ, elongatâ, columellâ plicatâ, basi albâ, labro tenui, acuto.

Habite les marais salins des environs de New York. Petite coquille ovulaire, lisse, couleur de corne, à test mince et translucide; elle appartient à la section des Conovules; sa spire est courte et obtuse, son ouverture longue et étroite a un bord droit, simple et tranchant; vers la base, la columelle offre deux petits plis blancs, égaux et peu obliques. Cette petite coquille a 10 millim. de long et 6 de large. (Desh. in Lam. l. c.)

#### MELAMPUS CINGULATUS PFEIFFER.

PLATE LXXV. FIGURES 12, 13.

T. imperforata, fusiformis, solida, sublævigata, nitida, fusca, fasciis inæqualibus albidis cingulata; spira convexo-conica, acutè-mucronulata; sutura simplex; anfr. 10, superi planiusculi, perangusti, ultimus  $\frac{3}{4}$  longitudinis fere æquans, basi attenuatus; apertura vix obliqua, angustissima, basi plica unica columellari valida, acuta, oblique ascendente bipartita; perist. simplex, acutum, margine dextro intus dentes 6-8, quorum infimum majorem, plicæformem, gerente. (Pfr.)

#### SYNONYMS AND REFERENCES.

*Auricula cingulata* PFEIFFER, in Wieg. Arch. f. Nat. 1840, i. p. 251.

CHEMNITZ, ed. 2, Auric. p. 40, t. 40, figs. 4-6.

*Auricula oliva* ORBIGNY, Moll. Cub. i. p. 189, t. 12, figs. 8-10.

*Auricula stenostoma* KÜSTER, olim, in Ind. fasc. 42, (teste Pfeiffer).

*Melampus cingulatus* PFEIFFER, Mon. Auric. Viv. p. 18.

*Auricula* JAY.

*Melampus* C. B. ADAMS, SHUTTL., POEY. } absq. descr.

*Tralia* H. & A. AD.

#### DESCRIPTION.

*Animal* not hitherto observed.

*Shell* imperforate, fusiform, heavy and thick, shining, polished, with numerous microscopic revolving lines, most prominent on the last whorl; brownish, with numerous irregularly wide, white revolving bands; spire convex-

conic, terminating in an acute transparent point; suture simple; whorls 10, the upper ones flattened and narrow, the last one tapering towards the base, and equalling about  $\frac{2}{3}$  the length of the shell; aperture hardly oblique, very narrow, divided at its base by a stout, sharp, columellar fold, which ascends and winds obliquely into the aperture; peristome simple, acute, armed within with from 6 to 8 elongated laminæ, not quite reaching the edge of the lip, the lower one being most fully developed.

Length of the specimen before me, 11; breadth, 5; length of aperture, 6 millimetres.

*Geographical Distribution.* The only American specimen of this species I have seen, was collected in Florida by Mr. Bartlett. The species is also found in Cuba, Jamaica, and Porto Rico.

*Remarks.* This is one of the species common to the peninsula of Florida and some of the West Indian Islands. It is well known that very many marine shells are also common to the same localities, so that it is easier to account for its presence than that of some strictly terrestrial species.

The shell cannot readily be confounded with any other known American species. It is readily distinguished by its elongated form, and peculiar enamel-like surface, which reminds one of the highly polished *Olivæ*.

The figure referred to is copied from Orbigny's *Mollusca* of De la Sagra's Cuba.

#### MELAMPUS COFFEA LINNÆUS.

##### PLATE LXXV. FIGURES 21, 25.

Testa imperforata, conica, solidissima, lævigata, nitens, lineis volventibus microscopicis, et rugis lævigatis incrementi notata; sub epiderme griseâ, livida, fasciis 3-4 albis, unâ ad carinam obtusam latâ, alteris angustioribus, cineta; sutura mediocris, spira brevis, conica, apice nigrâ, acutâ, nitente; anfr. 9-10, superi planiusculi, ultimus obtusè-subcarinatus,  $\frac{17}{19}$  long. testæ æquans; apertura subverticalis, longa, angusta, infra la-

tior,  $\frac{16}{19}$  long. æquans; perist. simplex, intus callis 1-3 longitudinalibus, albis, crassis, liras 15-22 transversales, immitentibus armatum; paries aperturalis dentes duos, albidos, intrantes, (supero multo majori) gerens; columella callo brunneo, nitente, induta, laminâ unicâ, in aperturam ascendente, armata; anfr. interni absorpti.

## SYNONYMS AND REFERENCES.

- Bulla coffea* LINNÆUS, Syst. Nat. x. p. 729.  
*Voluta coffea* LINNÆUS, Syst. Nat. xii. p. 1187.  
 SCHRÖTER, Einleit. ii. p. 200.  
 GMELIN, Syst. Nat. xiii. p. 3438.  
 DILLWYN, Descr. Cat. vol. i. p. 506.  
*Voluta minuta* GMELIN, Syst. p. 3436, ex parte.  
 DILLWYN, l. c. p. 506.  
*Auricula Midæ parva, fusca, albo-fasciata* MARTINI et CHEMNITZ, vol. ii. p. 119, pl. 43, fig. 445 ? (an potius *Mel. flavus* ?)  
*Ellobium Barbadosense* BOLTEX, Mus. Britt. p. 106, ed. nov. p. 74 ?  
*Bulinus coniformis* BRUGUIERE, Encycl. Meth. i. p. 339.  
*Melampus coniformis* MONTFORT, Conch. Syst. vol. ii. p. 318.  
 LOWE, Zool. Journ. vol. v. p. 292.  
 ADAMS, Contr. to Conch. p. 42, 186, (absq. descr.)  
 SHUTTLEWORTH, Bern. Mitth. (absq. desc.)  
*Melampus fusca* MÖRCH, Cat. Yold, p. 38, (teste Pfr.) (absq. desc.)  
*Melampus coffea* MÖRCH, Cat. Yold, p. 38, (teste Pfr.) (absq. desc.)  
*Melampus coffeus* ADAMS's Gen. Rec. Moll. vol. ii. p. 243, t. 82, figs. 7, 7 a, (absq. desc.)  
 POEY, Mem. sob. Hist. p. 394, (absq. desc.)  
*Melampa minuta* SCHWEIGGER, Handb. p. 739.  
*Tornatelle coniforme* BLAINVILLE, Dict. Sc. Nat. pl. Malac. 54, f. 4.  
*Auricula coniformis* FERUSSAC, Tab. Syst. p. 109, (absq. desc.)  
 LAMARK, Hist. an. s. Vert. vol. vi.  
 DESHAYES, in Lam. vol. viii. p. 332; ed. 3, vol. iii, p. 387.  
 POTIEZ et MICHAUD, Gal. vol. i. p. 202.  
 REEVE, Conch. Syst. ii. t. 187, f. 7, (teste Pfr.)  
 SOWERBY, Conch. Man. p. 77, f. 298 ?  
 CHEMNITZ, ed. 2; Auric. p. 31, t. 4, figs. 14-17.  
 PETIT, Journ. Conch. ii. p. 427, (absq. desc.)  
*Auricula ovula* ORBIGNY, Moll. Cub. vol. i. p. 187, t. 13, figs. 4-7, (1853).  
*Conorulus coniformis* LAMARK, Encycl. Meth. t. 459, fig. 2, (absq. desc.)  
 ANTON, Verz. p. 48, (absq. desc.)  
 WOODWARD, Man. Moll. t. 12, f. 37; p. 173, (1854).  
*Conorulus coffeus* BECK, Ind. p. 106, (absq. desc.)  
*Conorulus coffee* GRAY, Turt. Man. p. 20, (absq. desc.)

## DESCRIPTION.

*Animal* (from figure in Adams's Genera, copied on pl.

75, fig. 21) about the length of the shell; tentacles short, pointed, eyes at their interior base; proboscis extending beyond the head, bilobate, bluntly terminating; posterior termination of the foot short, bifid, color dark brown.

*Shell* imperforate, cone-shaped, very solid and heavy, smooth and shining in fresh specimens, with delicate wrinkles of growth, and very numerous microscopic revolving lines; light fawn-color when deprived of its russet epidermis, with three or four revolving bands of white on the body whorl, of which the uppermost is broadest; suture moderate; spire short, conic, apex black, shining, pointed; whorls from 9-10, the upper ones flattened, the last obtusely angulated below the suture,  $\frac{17}{19}$  the length of the entire shell; aperture subvertical, long and narrow, gradually widening towards the base of the shell, about  $\frac{16}{18}$  the entire length of the shell; peristome acute, not reflected, but thickened within by a heavy white callus, extending as high up as the carina of the body whorl; on this callus are from 15 to 22 white, transverse laminæ or ridges, not reaching the edge of the peristome, and not entering far into the aperture; sometimes there is a second and even third series of these laminæ visible within the aperture; on the parietal wall are two elevated, white, entering folds, the upper one much more prominent; the columella is covered with a shining, brown callosity, and furnished with one rather prominent fold, which commences at the termination of the peristome, and winds upwards into the interior of the shell; the interior whorls and axis are entirely absorbed.

Diameter of a large specimen, 10; length, 19 diameters.

*Geographical Distribution.* The only specimens I have seen were collected in Florida by Mr. Bartlett, more than ten years ago.

It is a well known and very common shell in the West Indies. Referred also to Mexico by Pfeiffer.



*Remarks.* Figure 25 of plate 75 is a fac-simile of Orbigny's figure of *Auricula ovula*. It is a good representation of our Florida shells.

West Indian specimens are well known in cabinets. I know of no American specimens, with the exception of the few collected by Mr. Bartlett.

Pl. 79, fig. 6, may represent a variety of this species. It is from Texas.

#### MELAMPUS FLORIDIANUS SHUTTLEWORTH.

##### PLATE LXXV. FIGURE 30.

*T. imperforata*, ventroso-fusiformis, tenuis, sublævigata, griseo-fulva; fasciis castaneis variè ornata; spira regulariter conica, acuta; sutura linearis; anfr. 10 plani, superiores radiato-striati, ultimus  $\frac{2}{3}$  longitudinis formans, supernè obsoletè angulatus, versus basin valdè attenuatus; apertura subverticalis, angusta, utrinque angulata; plicæ parietales 2 minutæ, approximatae; plica columellaris valida, obliquè ad basin producta; perist. acutum, margine dextro (in adultis) intus plicis albis transversis subæqualibus munito, columellari brevi, calloso. (Pfr.)

##### SYNONYMS AND REFERENCES.

*Auricula Floridiana* SHUTTLEWORTH, MSS.

*Melampus Floridianus* (Tralia) ADAMS, Proc. Zoöl. Soc. 1854, ii. (absq. desc.)

PFEIFFER, Malak. Blatt. 1854; Mon. Auric. Viv. 36.

*Tifata Floridiana* ADAMS, Gen. Rec. Moll. ii. 245, absq. desc.

##### DESCRIPTION.

*Animal* not observed.

*Shell* imperforate, ventricose, fusiform, thin, smooth, grayish, with varying chestnut bands; spire regularly conic, acute; suture linear; whorls 10, flattened, the upper ones radiately striate, the last comprising  $\frac{2}{3}$  of the length of the shell, obsoletely angulated above, and very much smaller at its base; aperture subvertical, narrow, angular; 2 parietal plicæ, one strong, one on the columella, obliquely continued towards the base; peristome acute, its right side in adult specimens armed with transverse,

white, subequal folds, its columellar portion both short and callous.

Length,  $7\frac{1}{2}$ ; diameter,  $4\frac{1}{3}$ ; aperture in length almost 5, in breadth  $1\frac{1}{3}$  millimetres.

*Geographical Distribution.* Florida Keys. (Bartlett.)

*Remarks.* Pfeiffer compares it with *Mel. cingulatus*. It appears to me easily distinguished from that and the other species of the United States.

#### MELAMPUS FLAVUS GMELIN.

*T. imperforata*, oboconica, lævigata, castanea, fasciis 3 angustis pallidis ornata; spira brevis, convexo-conoidea, mucronata; sutura linearis; anfr. 9-10, superi planiusculi, ultimus  $\frac{3}{4}$  long. fere æquans, basi arcuato-cristatus; apertura subverticalis, angusta, basi angulata; plica 1 parietalis profunda; plica columellaris valida, subverticalis, ad basim porrecta; perist. rectum, acutum, margine dextro fusco-labiato, intus albo-callosa, costis sub 10 transversis, brevibus! munito, columellari calloso, dilatato. (Pfr.)

#### SYNONYMS AND REFERENCES.

LISTER Hist. t. 834, fig. 60.

FAYANNE Conch. t. 65, fig. H, i.

*Auricula Midæ* parva, &c. MART. and CHEMN. ii. p. 119, 126, t. 43, f. 445.

*Voluta* n. 106, SCHRÖTER, Einl. i. p. 272.

*Voluta flava* GMELIN, Syst. p. 3436, No. 5.

DILLWYN, Cat. i. p. 506, n. 17.

*Voluta flammea* γ GMELIN, l. c. 3435, n. i.

*Bulinus monile* BRUGUIERE, Encycl. Meth. i. p. 338, n. 70.

*Melampa monile* SCHWEIGGER, Handb. p. 739.

*Conovulus monile* GOLDFUS, Hand. p. 657.

*Conovulus flavus* ANTON, Verz. 1776.

*Auricula monile* FERUSSAC, Podr. p. 105.

LAMARK, Hist. vi. 2, p. 141: ed. Desh. viii. p. 333.

KÜSTER in Chemn. ed. 2, Auric. p. 30, pl. iv. figs. 7-9.

*Auricula flava* DESHAYES in Lam. viii. p. 33.

PETIT, Journ. Conch. ii. 1851, p. 427.

*Auricula coniformis* ORBIGNY, Cuba.

*Melampus monile* LOWE, Zool. Journ. v. p. 292.

BECK, Ind. p. 108.

*Melampus minutus* β BECK, l. c. 107.

*Melampus flavus* ADAMS, Contr. p. 42, 186.

POEY, Mem. i. 394.

PFEIFFER, Mon. Auric. Viv. 21.

*Melampus torosa* MÜRCH, Cat. Yold. p. 38.

*Melampus monilis* SHUTTLEWORTH, Diagn. No. 7, p. 162.

#### DESCRIPTION.

*Animal* not observed.

*Shell* imperforate, obconic, smooth, chestnut-colored, with 3 light, narrow bands; spire short, convex conic; suture slightly impressed; whorls from 9 to 10, the upper ones flattened, the last about equalling  $\frac{3}{4}$  of the length of the shell, arcuately ridged below; aperture subvertical, narrow, angulated below; one deep parietal fold, one subvertical, stout columellar fold, extended towards the base; peristome straight, acute, its outer margin reddish, thickened with white within and furnished with 10 short, transverse ribs, its columellar portion expanding and callous.



Length, 12; breadth,  $8\frac{3}{4}$ ; length of aperture,  $9\frac{1}{2}$ ; breadth at the middle, 3 millimetres.

*Geographical Distribution.* Collected in Florida by Mr. Bartlett.

*Remarks.* This species is a well known inhabitant of the West Indian Islands, but whether its presence in Florida is accidental or not, I cannot say. It is readily distinguished from the other Florida species.

The synonymy is Pfeiffer's.

#### MELAMPUS OBLIQUUS SAY.

Obconic, reddish brown, rather thick; spire very little elevated; whorls eight or nine, wrinkled across; labium with two very distinct teeth, and an intermediate and equidistant slight obtuse prominence; inferior tooth very oblique, terminating at the base; labrum with about eight teeth or striæ, which terminate on the margin; base of the aperture a little contracted by the basal tooth.

Length more than seven twentieths of an inch. I am indebted to Mr. Stephen Elliott for this species, who obtained it on the coast of South Carolina. It is closely allied to *Bulinus monile* Brug., but it has no appearance of bands, which distinguish that shell. In the collection of the Academy are specimens from the West Indies. (Say.)

## SYNONYMS AND REFERENCES.

*Melampus obliquus* SAY, Journal Acad. Nat. Sc. Phila. vol. ii. p. 377, (Dec. 1822); Binn. ed. p. 27.

PFEIFFER, Mon. Auric. Viv. p. 30.

*Auricula obliqua* DEKAY, N. Y. Moll. p. 58.

*Melampus* BECK, *absq. desc.*

*Remarks.* It is not now known what shell Say had in view when the above description was written. No authentic specimen is preserved, and no author has seen any shell from that locality answering to the characters laid down. DeKay mentions it among the extra-limital species in his report, his words being nearly a repetition of Say's. Pfeiffer repeats Say's words, and suggests the identity of the species with *Melampus coffea*. Say being familiar with that shell (*M. coniformis*, vid. ed. Binn. p. 85), it seems hardly probable he would have described a variety of it.

The question must remain undecided until we are better acquainted with the species of the South Carolina coast.

**MELAMPUS PUSILLUS** GMELIN.

## PLATE LXXV. FIGURE 29.

Testa imperforata, elongato-ovata, solida, nitens, lævigata, lineis microscopicis volventibus notata; rufa, fasciis indistinctis magis candidis cineta; sutura non valdè impressa; spira elongato-conica, apex nigra, acuta, nitens; anfr. 6-7, superi planiusculi, ultimus obtusè angulatus, ad basin regulariter attenuatus,  $\frac{1}{2}\frac{8}{3}$  testæ long. æquans; apertura subverticalis, supra angusta, infra rapidè dilatans, testæ long.  $\frac{1}{2}\frac{5}{3}$  æquans; perist. simplex, acutum, intus callosum et plicam obtusam intus positam gerens, margine basali appresso et in plicam columellarem intrantem ascendente;



paries et columella callo nitente induta; dentes parietales duo, intrantes, albidii, infero magiori; septæ internæ absorptæ.

## SYNONYMS AND REFERENCES.

*Auricula Mide parva fusca unicolor* MARTINI and CHEMNITZ, vol. ii. p. 119, t. 43, f. 446.

FAVANNE, t. 65, f. H. 4, (teste Pfr.)

*Voluta* n. 108 SCHRÖTER, Einl. i. p. 273.

*Voluta pusilla* GMELIN, Syst. p. 3436, (teste Pfr.)

DILLWYN, Cat. i. p. 507.

WOOD, Index, t. 19, fig. 20.

*Voluta triplicata* DONOVAN, Brit. Shells, vol. v. pl. 138, (1808).

MONTAGU, Test. Brit. Suppl. p. 99.

DILLWYN, Cat. p. 507.

WOOD, Ind. pl. 19, f. 19.

*Bulimus ovulus* BRUGUIERE, Encycl. Meth. i. p. 339.

*Melampa ovulum* SCHWEIGGER, Handb. p. 739, (teste Pfr.)

*Auricula ovula* ( *Conovula* ) FERUSSAC, Tabl. Syst. p. 108, (absq. desc.)

*Auricula nitens* LAMARK, An. s. Vert. vol. vi. 2, p. 141.

DESHAYES in Lam. vol. viii. p. 332; ed. 3, vol. iii. p. 387.

CHEMNITZ, ed. 2, Auric. p. 18, pl. ii. f. 11-13.

*Auricula pusilla* DESHAYES in Lam. vol. viii. p. 332.

JAY, Cat. (absq. desc.) p. 265.

*Auricula leucodonta* NUTTALL, mss. teste H. et A. ADAMS.

*Conovulus nitens* VOIGHT in Cuv. Thierr. III. p. 112, (teste Pfr.)

*Conovulus pusillus* ANTON, Verz. p. 48.

FORBES and HANLEY, Brit. Moll. vol. iv., p. 197, (absq. desc.)

*Melampus pusillus* C. B. ADAMS, Contr. Conch. p. 42, 186, (absq. desc.)

PFEIFFER, Monog. Auric. Viv. p. 48.

POEY, Mem. i. p. 394, (absq. desc.)

SHUTTLEWORTH, absq. desc.

*Pythia ovulum* BECK, Ind. p. 104, (teste Pfr.)

*Pythia triplicata* BECK, Ind. p. 104, (teste Pfr.)

*Tralia pusilla* GRAY in Turt. Man. p. 21, (absq. desc.)

H. et A. ADAMS, Gen. Rec. Moll. vol. ii. (Sept. 1855,) p. 244, pl. 82, f. 8.

*Trulia ovulum* MÖRCH, Cat. Yold. p. 38, (teste Pfr.) absq. desc.

## DESCRIPTION.

*Animal* not observed.

*Shell* imperforate, lengthened ovate, solid, shining, smooth, marked with microscopic revolving lines, most easily detected on the spire; reddish-brown, with lighter, hardly perceptible revolving bands; suture moderate, less ragged than in the other species; spire elongate-conic;

apex acute, shining, black; whorls 6-7, the upper ones flattened, the body whorl obtusely carinated, regularly decreasing in diameter towards the base, and equalling about  $\frac{18}{23}$  the length of the shell; aperture subvertical, narrow, rapidly widening towards its base, and equalling in length about  $\frac{15}{23}$  of the entire shell; peristome simple, acute, within thickened by callus, and furnished with a rather blunt, short, transverse, not very prominent lamina; the basal termination of the peristome is appressed to the shell, and imperceptibly terminates in a columellar lamina which ascends and winds into the aperture; the columella and parietal wall are covered with a shining callus; there are two parietal teeth, which are white, and enter into the aperture of the shell, the lower one being much the smaller. Internal septæ absorbed.

Greatest diameter, 5; length, 11 millimetres.

*Geographical Distribution.* The only American specimens I have seen are in my collection. I detected them among minute marine shells and sand, collected in Florida by Mr. Bartlett.

*Remarks.* This species is well known in cabinets by specimens from the West Indian Islands, in several of which it exists. Pfeiffer also refers it to the Sandwich Islands.

The shell resembles an *Oliva*. It is readily distinguished by its polished, mahogany-colored shell. It varies less than most of the *Melampi*.

#### MELAMPUS REDFIELDI PFEIFFER.

T. subrimata, ovata, solidula, striatula, nitidula, albida, fasciis variis spadiceis plerumque interruptis subtessellata; spira brevis, convexo-conoidea, acuta; sutura vix impressa; anfr. 9-10, planiusculi, ultimus  $\frac{3}{4}$  longitudinis fere formans, supernè obsoletè angulatus, basi attenuatus; apertura vix obliqua, oblonga, supra basin subdilatata; plicæ parietales 2, supera major, transversa, altera approximata, dentiformis; plicæ columellaris acuta, arcuatim in marginem basalem continuata; perist. simplex,

margine dextro supernè subsinuato, tum fere stricto, intus serie profundâ plicularum brevium, confertissimarum munito, columellari calloso, albo, subappresso. Long. 12, diam. max. 7 mill. Ap. 10 mill. longa, medio  $2\frac{1}{2}$  lata. (Pfr.)

*Remarks.* This species is inserted with some doubt among the American *Melampi*. Some immature specimens found in Florida cannot be referred to any of the other species I have enumerated. Having sent them to Mr. Redfield, he writes me that they do not in any way differ from immature specimens of *Melampus Redfieldi*, which he has from Bermuda.

The above description is from the Monograph of *Auriculacea*, p. 35.

#### SPURIOUS SPECIES.

*Melampus borealis* Conrad, I have referred to *Alexia myosotis*.

*Melampus denticulatus* Stimpson, is also identical with *Alexia myosotis*.

#### SUBFAMILY AURICULEA.

Animal terrestrial, living in moist localities; shell with an expanded or thickened peristome. (Pfr.)

It forms the subfamily *Ellobiinae* of Adams's Genera.

The American genera are as follows:—

#### GENUS AURICULA LAMARK.

No species of this genus, as restricted by Pfeiffer, is found in the United States. The following list contains all the species described as *Auriculæ*, and the position in which they are now classed.

*Auricula bidentata* Gld., &c. is the same as *Melampus*.

*A. biplicata* Desh. is the same as *Melampus bidentatus*.

*A. cingulata* Pf. &c. is the same as *Melampus cingulatus*.

*A. coniformis* Fer. is the same as *Melampus coffea*.

*A. cornea* Desh. is the same as *Melampus bidentatus*.

- A. denticulata* Gld., DeK. is the same as *Alexia myosotis*.  
*A. Floridianus* Shutt. is the same as *Melampus Floridianus*.  
*A. Jaumei* Mitre is the same as *Melampus bidentatus*.  
*A. nitens* Lam. is the same as *Melampus pusillus*.  
*A. obliqua* DeK. is the same as *Melampus obliquus*.  
*A. oliva* Orb. is the same as *Melampus cingulatus*.  
*A. pusilla* Desh. is the same as *Melampus pusillus*.  
*A. Sayi* Küster is the same as *Leuconia Sayi*.  
*A. stenostoma* Küster is the same as *Melampus cingulatus*.

## GENUS ALEXIA LEACH.

Shell oblong-ovate, thin, spire pointed; last whorl large, rounded at base; aperture rather broad, oval, acuminate; parietal wall furnished with from 1 to 5 tuberculous laminae; columellar fold oblique; peristome expanded, armed with teeth, or thickened within. (Pfr.)

The species of this genus are truly terrestrial, though many authors consider them marine.

We have but one species, *A. myosotis*. The figure of its animal given on pl. 79, fig. 16, will be found to differ somewhat from the figure given in Adams's Genera, which I have copied on pl. 75, fig. 22.

## ALEXIA MYOSOTIS DRAPARNAUD.

PLATE LXXV. FIGURE 33. PLATE LXXIX. FIGURE 16.

T. minutè perforata, elongato-ovata, tenuis, lævigata, nitens; cornea lineâ rufâ suturalis cincta; spira producta, apice acuta; sutura impressa; anfr. 7-8, superi convexiusculi, ultimus elliptico-ovatus  $\frac{5}{7}$  longitudinis testæ æquans; apertura ovata, subverticalis,  $\frac{4}{7}$  long. testæ æquans; perist. tenue, acutum, margine dextro interdum intus armato, basali, appresso, reflexiusculo, in plicam columellarem intrantem ascendente; paries aperturalis plicis duobis albis armata, superâ parvulâ, alterâ erectâ, acutâ, transversim intrante.

## SYNONYMS AND REFERENCES.

*Auricula myosotis* DRAPARNAUD, &c.

*Auricula denticulata* GOULD, Invert. of Mass. p. 199, fig. 129, (excl. *Voluta denticulata* Mont. et syn. suis.) nec MONTFORT.



*Auricula denticulata* DEKAY, N. Y. Moll. p. 58, pl. v. figs. 91, 93, (excl. *Voluta denticulata* Mont. et. syn.) nec MONTFORT.

*Melampus denticulatus* STIMPSON, Shells of N. E. p. 52, (absq. desc.) excl. syn. Mont.

*Melampus borealis* CONRAD, Am. Journ. Sc. vol. xxiii. p. 345, (1833).

*Alexia myosotis* H. et A. ADAMS, Gen. Rec. Moll. vol. 2, p. 241, (Sept. 1855,) absq. desc.

PFEIFFER, Mon. Auric. Viv. p. 148.

#### DESCRIPTION.

*Animal* short, about one half the length of the shell, dirty white, darker on the head and tentacles; eyes black, placed at the inner base of the feelers; feelers quite short, wrinkled, bulbous at tip, sufficiently dark to be visible through the thin shell when the animal withdraws itself; head continued beyond the tentaculæ into an obtuse, short, bilobed snout; the shell is carried horizontally on the animal's back; the obtusely pointed posterior termination of the foot is just visible beyond the shell; the animal is sluggish in its movements. See plate.

*Shell* elongate-oval, thin, semi-transparent, smooth and shining; dark horn-color, with a narrow reddish sutural line; spire produced with an acute apex; suture distinctly impressed; whorls from 7 to 8, the upper ones rather convex, the last one elliptically ovate, equalling  $\frac{5}{7}$  of the shell's length; aperture subvertical, about  $\frac{4}{7}$  the length of the shell; peristome thin, sharp, sometimes furnished with tooth-like folds on its inner side; its basal termination appressed to the shell, slightly reflected over a minute perforation, and turning upwards till it blends with the columellar fold, which winds into the aperture; the parietal wall is furnished with a white, transverse, thin, and sharp denticle, and a second smaller, much less prominent one, placed above it.

Greatest diameter 4, length 8 millimetres.

*Geographical Distribution.* Found in Massachusetts Bay, (Gould, Stimpson, Tufts); New York harbor, (De-

Kay); Rhode Island, (Conrad?) It is also a well-known inhabitant of parts of the coasts of England, France, Spain, &c.

*Remarks.* I have placed this shell in this genus on the authority of Pfeiffer and of Adams Genera. It has been placed in many different genera by European authors. In America it has been considered an *Auricula* by Gould and others, until Stimpson classed it among the *Melampi*. From the exterior of the animal there appears no difference between it and *Melampus bidentatus*. It does not even agree with the animal of *Alexia*, given by Adams in the Genera of Recent Mollusca, which I have copied on pl. 75, fig. 22. This figure represents the true *Alexia denticulata* Montfort, with which Gould confounds this species. The shell is also quite distinct. It is, however, united to *Alexia myosotis* by Forbes and Hanley, in their work on British Mollusca. Pfeiffer considers them distinct.

It is probably an imported species, as Stimpson remarks, (l. c.,) being found only in the Atlantic seaports. At Boston it is common on the piers of the wharves in the harbor. It is also found on isolated stones which are immersed by the rising tide at least four hours out of the twelve. When placed in fresh water it becomes benumbed and dies.

There can be no doubt of *M. borealis* Conrad being identical with this species. Conrad's description is given below, as is also a description of it found among Say's manuscripts, but never published.

DeKay also says :

The *borealis* of Jay's Cat., of an olive-green color, an elevated apex, and with slightly impressed sutures, with a thin transverse tooth above and a small sinous tooth beneath, I suppose to be a young variety of the above described species, (*A. myosotis*).

MELAMPUS TURRITUS. Ovate-acute, polished, dull whitish; spire prominent, tapering, of eight whorls; aperture rather wide, not longer

than the spire; labium two-toothed; lower tooth small; labrum without teeth. Length one fifth of an inch. Inhabits Rhode Island.

This species is remarkable for the elevation of its spire, and it is the smallest species I have seen, and was presented to me by Dr. Griffith. (Say).

**MELAMPUS BOREALIS.** Shell ovate-acute, elongated; pale horn-color, with darker longitudinal bands; whorls 6 or 7, with a revolving impressed line below the suture; spire elevated, conical; columella with three distant and distinct plaits, the middle one most prominent; aperture obovate-acute. Length, about one fourth of an inch.

This small species of *Melampus* has been found sparingly on the coast of Rhode Island, by Lieut. Brown of Newport. It is similar in form to a *Bulimus*, and is very unlike the common species with which it associates. (Conrad).

#### GENUS BLAUNERIA SHUTTLEWORTH.

Shell imperforate, oblongly turreted, thin; aperture narrow, elongated; parietal wall with one fold near the columella, which is subtruncated; peristome simple, not reflected. (Pfr.)

This genus was proposed for the following species. Its habits and the characteristics of the animal remove it from *Achatina* and *Oleacina*, where it was formerly placed.

#### BLAUNERIA PELLUCIDA PFEIFFER.

##### PLATE LIII. FIGURE 2.

Testâ sinistrorsâ, ovatâ, elongatâ, hyalinâ, politâ, dilutè corneâ; spirâ obtusâ, anfractibus ad septem convexiusculis; suturâ lineari; aperturâ angustâ, labro acuto; columellâ brevi, lamellâ intus decurrente supernè instructâ. (Gld.)

##### SYNONYMS AND REFERENCES.

*Achatina pellucida* PFEIFFER, in Wieg. Archiv. 1840, i. 252.

GOULD in Binn. Terr. Moll. ii. 294.

*Tornatellina Cubensis* PFEIFFER, Symb. ii. 130; Monog. Helic. Viv. ii. 391.

CHEMNITZ, ed. 2, Pupa. p. 151, pl. xviii. figs. 16, 17.

*Blauneria pellucida* PFEIFFER, Malak. Bl. 1854; Mon. Auric. Viv. 153.

*Odostomia?* *Cubensis* POEY, Mem. i. 394.

*Oleacina Cubensis* ADAMS, Gen. ii. 106, absq. desc.

## DESCRIPTION.

*Animal* not observed.

*Shell* sinistral, ovate-lanceolate, acuminate, pellucid, highly polished and glistening. Whorls seven, very oblique, scarcely convex, the last one somewhat ventricose towards the base, about two thirds the length of the shell. Aperture narrow ovate, acutely prolonged posteriorly; lip simple; turning up the columella it becomes thickened, and winds into the aperture in the form of a tooth-like lamella.

Length one tenth of an inch; breadth one thirtieth of an inch.

*Geographical Distribution.* Found in Florida, among small shells drifted in the sand.

Dr. Foreman collected a few specimens in a garden of Washington city. He believes them to have been brought on plants from Charleston, S. C.

It has been detected in Cuba, Jamaica, and Porto Rico, and has been introduced into England.

*Remarks.* Perhaps no shell has rejoiced in more numerous and longer names, both generic and specific, than this minute one. Nor has the true station of any one been more difficult to decide. It is now, however, acknowledged to be air-breathing, and amphibious in its habits.

Binney is the only American author who mentions its existence in this country. He places it under *Achatina*. Gould, in Terr. Moll., leaves it in that genus provisionally, mentioning the doubt existing concerning it.

Shuttleworth in letters to Bland adds to the synonymy.

*Voluta heteroclita* MONT., LASKEY.

*Actæon heteroclita* FLEMING.

*Auricula heteroclita* THORPE.

*Tornatella? heteroclita* FORBES & HANLEY.



Should he be correct, the species would stand, by the rule of priority, as *Blauneria heteroclita* (*Voluta*) Mont.

This species is readily distinguished among the fine sand, shells, &c., washed ashore in Florida, by its bright, shining surface, and reversed form. All the specimens I have seen were collected by Mr. Bartlett more than ten years ago, excepting those found by Dr. Foreman.

#### GENUS LEUCONIA GRAY.

The following species is doubtfully referred to this genus by Küster and Pfeiffer. But, as observed in the remarks, it is very doubtful whether the genus exists at all in this country.

#### LEUCONIA (?) SAYII, KÜSTER.

##### PLATE LXXV. FIGURE 34.

A. testa minima, conico-ovata, nitida, cornea, striata; spira acuta, latè conica, anfr. 6 convexiusculis; apertura oblonga, columella bicipitata.

Eine der kleinsten Arten. Das Gehäuse ist dünnwandig, stark durchscheinend, regelmässig gestreift, seidenglänzend, hornfarben; das Gewinde hoch, breit kegelförmig, im Allgemeinen in der Mitte convex, der Wirbel fein zugespitzt, die einzelnen Windungen sind niedrig, flachgewölbt, durch eine etwas vertiefte Naht vereinigt. Hauptwindung ziemlich gross, bauchig, unten verschmälert; Mündung länglich, zugespitzt, nach unten erweitert; Mundsaum dicht anliegend, geschweift absteigend, geradeaus, stumpf zugeschärft; Spindelsäule mit geringem Umschlag und zwei weissen Falten, die obere ist zahnartig zugeschärft, die untere tritt schief heraus und geht unmittelbar in den Rand des Mundsaums über. Zuweilen bemerkt man oberhalb noch eine kleine faltenartige Schwielle, jedoch nur bei ganz alten Exemplaren. Höhe  $2\frac{1}{2}'''$ , Breite  $1\frac{1}{2}'''$ .

Aufenthalt: in den vereinigten Staaten von Nordamerika.

#### SYNONYMS AND REFERENCES.

*Auricula Sayii* KÜSTER, in Chemnitz, ed. 2, Auric. p. 42, pl. vi. figs. 14, 15.

*Leuconia Sayii* H. et A. ADAMS, Gen. Rec. Moll. vol. ii. p. 248, 1855, (absq. desc.)

PFEIFFER, Mon. Auric. Viv. p. 157.

*Remarks.* The above is Küster's description. The figure to which I refer is a fac-simile of one of his. This is the only information I have been able to obtain with regard to the species. It has not been described by any other author but Pfeiffer, who merely quotes the above description, not having ever seen the shell.

Küster's figure represents no known American shell; there exists, however, a strong resemblance between it and his figure of *Alexia myosotis*. His original specimen may have been a variety of that species.

Pfeiffer compares the species with *Melampus infrequens* Ad.

#### GENUS CARYCHIUM MÜLLER.

Shell pupa-shaped, very thin, transparent, with but few whorls; aperture suboval; with one dentiform columellar fold, sometimes obsolete; parietal wall with 1 or 2 teeth; peristome expanded, terminations not approximating, the right hand one with one internal tooth. (Pfr.)

See the remarks under the following species.

#### CARYCHIUM EXIGUUM SAY.

##### PLATE LIII. FIGURE 1.

C. testâ minutissimâ, albâ, fusiformi, sub-acuminatâ; anfractibus quinque vel sex, obliquis, convexis; aperturâ obliquâ; columellâ dente albo ornatâ; labro albo, reflexo.

##### SYNONYMS AND REFERENCES.

*Pupa exigua* SAY, Journ. Acad. ii. 375; ed. Binn. p. 26.

GOULD, Boston Journ. iii. 398, pl. 3, f. 20. Invertebrata, 191, f. 120.

DEKAY, New York Report, 31; Fauna, 49, pl. iv. fig. 46.

ADAMS, Vermont Mollusca, 8.

*Bulinus exiguus* BINNEY, ii. 286.

*Carychium exiguum* GOULD, in Terr. Moll. ii. 286.

CHEMNITZ, ed. 2, p. 61, pl. i. figs. 13, 14.

STIMPSON, Shells of N. E. p. 52, (absq. desc.)

FRAUENFELD, 1847, Akad. der Wiss. xix. p. 79; Zoöl. Bot.

Wien, iv. p. 10, pl. 1, fig. 1.

BOURGIGNAT, Mag. Zoöl. 1857, p. 209.

*Carychium exile* H. C. LEA, Am. Journ. 42, 109, pl. i. fig. 5.

TROSCHER, Ar. f. Nat. 1843; ii. 128.

*Carychium existelium* BOURGIGNAT, l. c. p. 220.

*Carychium euphæum* BOURGIGNAT, l. c. p. 221.

## DESCRIPTION.

*Animal* colorless; tentaculæ stout, hyaline, one third the length of the foot, the upper pair alone developed. The foot is short, thick, distinctly divided into two segments, the anterior of which is bilobed, and projects, when the animal is in motion, considerably in advance of the head. Eyes oval, situated on the back, near the base of the tentacles. Its motions are very sluggish. It carries the shell directed horizontally; the shell is so transparent that the viscera of the animal may be seen through it. (Compare the figures of the animal on plate 53.)

*Shell* elongated, tapering at both ends, white, translucent, shining; apex rather obtuse; whorls five to six, convex, very oblique, with transverse striæ; suture distinct, impressed; aperture obliquely oval, white, with a prominent plait on the columellar margin, about midway between the extremities of the lip, and a slightly prominent fold near the junction of the lip with the umbilical extremity of the shell; lip thick, reflected, flattened; umbilicus perforated.

Length, one fifteenth; breadth, one fortieth of an inch.

*Geographical Distribution.* Common in all the Northern and Middle States (Binney), in Ohio (Kirtland, Anthony, Higgins), and Arkansas (Gould), New York (DeKay, Lewis), Michigan (Winchel), Massachusetts (Gould, &c.), Connecticut (Linsley), Maine (Mighels), Pennsylvania (H. C. Lea), Texas (Röemer).

*Remarks.* The extreme minuteness of this shell has doubtless prevented its being noticed in many localities where it exists. It probably inhabits a very wide range of territory. The plane of the aperture is not so nearly parallel with the axis as in *Bulimus subula*. It has been said to resemble *Carychium minimum* of Müller, but neither the figure nor description, as given by Draparnaud, correspond with our shell.

It is found under stones and fragments of wood, and especially among moss, in damp places. Though found far removed from the influence of the sea over a wide extent of country in the interior, it still possesses a fondness for the sea in common with the other species of the family. Around Boston they are found at or below the surface in swamps, growing among mosses.

It is the only species of this family inhabiting the interior.

This minute shell is well known in American cabinets as a *Pupa*. Say described it as such in 1822, though he mentions the probability of its being a *Carychium*. It has been described since that time as a *Pupa* by Gould, DeKay, and Adams, and catalogued among the species of the same genus by all the American writers who have mentioned it, until 1851, when its correct position was pointed out by Stimpson and Gould. The former places it in his family of *Melampidæ*. The latter thus writes:—

“This shell should be removed to another family, under the name of *Carychium exiguum*. Besides the peculiar structure of the shell, and the form of its aperture, the position of the eyes of the animal plainly remove it from the true *Helicidæ*, and associate it with the *Auriculidæ*. Its habits, and the characters of the shell, also indicate the same relation.”

Dr. Binney, in 1843, (Boston Journal, p. 106,) considers it a *Pupa*. In his great work he places it under *Bulimus*.

Notwithstanding its distinct generic peculiarities having been pointed out in 1851, we find the shell considered as a *Pupa* in several American catalogues as late even as 1857; (vid. Boston Proc. vi. p. 128.)

In 1852, Jay removed it from *Pupa* to *Carychium*; (Cat. p. 263.)

In Europe, we find its true position pointed out by



Pfeiffer as early as 1841, and adhered to by subsequent writers.

I have added to the synonymy of this species *Carychium exile* H. C. Lea, a shell I have never seen. Dr. Gould has expressed the same opinion; (Bost. Proc. i. p. 61.) Though there seems to me no room for doubt of the justness of this decision, I add the description of Mr. Lea, as well as a somewhat reduced copy of his figure (pl. 75, fig. 23) of the aperture.

I add also a copy of M. Bourignat's description of *C. existelium* and *C. euphæum*. Persons may thus judge for themselves whether my decision is correct. I have not seen authentic specimens.

CARYCHIUM EXILE (pl. 1, fig. 5). C. testâ ovato-conicâ, valdè elevatâ, subperforatâ, diaphanâ, albidâ, longitudinaliter striatâ; spirâ obtusâ; anfractibus senis, convexis; suturis impressis; aperiturâ ellipticâ, integrâ, dentibus tribus; labio valdè reflexo.

Shell ovately conical, much elevated, subperforate, diaphanous, whitish, longitudinally striate; spire obtuse; whorls six, convex; sutures impressed; mouth elliptical, entire, with three teeth; lip much reflexed. Length, .075; breadth, .025 of an inch.

Hab. Under dead leaves and mould, on the Wissahiccon Creek, near Philadelphia. Cabinet of I. Lea.

Remarks. This beautiful little shell bears a strong resemblance to the *Pupa exigua* of Say, and it is with some doubt that I propose it. The chief points in which it differs from that shell are the following. The lip is continuous round the mouth, and not interrupted by the last whorl, as is the case with the *Pupa*, thus being a true *Carychium*; the lip is flattened, the number of whorls is greater, there is a tooth on the outer lip, the size is smaller, and the shape more elongated. It also nearly approaches the *Carychium minimum* Leach, a European shell, but may be easily distinguished by its striæ, shape, number of whorls, perforation and teeth. The tooth on the outer lip is very variable, being sometimes almost obsolete, and sometimes larger than those on the inner one. Of the two teeth on the inner lip, one is placed at the middle, and

the other very near the base of the mouth, and so far in as to be almost invisible on a front view. The mouth is .02 of an inch in length. It appears to be the only true *Carychium* yet found in the United States, its small perforation, hardly amounting to an umbilicus, not being sufficient to separate it from that genus. In its shape and mouth it strongly resembles the genus *Clausilia*, but it wants the clausum, the distinctive mark of that curious and interesting genus. I have only met with it on the Wissahiccon, where it does not seem to be very common.

**CARYCHIUM EXISTELIUM.** Testa vix rimata, elongato-turrita, hyalina, lævi, vel vix striatula; spira elongata, acutiuscula; anfr. 6 convexis; ultimo  $\frac{1}{3}$  longitudinis æquante; apertura parum obliqua, ovata, paululum parvula; pariete aperturali prope columellam dente minutissimo munito; peristomate reflexo; margine externo paululum intus inflexo.

Coquille turriculée, très-allongée, hyaline, lisse ou à peine striée, et munie d'une fente ombilicale peu sensible. Spire allongée, à sommet aiguë. Six tours très-convexes, dont le dernier égale le tiers de la longueur totale. Ouverture peu oblique, ovale, proportionnellement petite, ornée seulement d'une seule denticulation peu saillante située près de la columelle. Péristome réfléchi. Bord extérieur un peu infléchi en dedans.

Long.  $2\frac{1}{2}$  mill.; diam.  $\frac{3}{4}$  mill.

Habite les États-Unis d'Amérique. Nous ne connaissons point la localité précise où a été recueilli ce Mollusque.

Le *Carychium existelium* se distingue du *Carychium exiguum*, avec laquelle il peut être assimilé, par sa taille plus élancée, plus grêle; par sa bouche moins dilatée et munie d'une seule denticulation située sur la paroi aperturale, vers l'insertion de la columelle; par sa columelle lisse; par sa suture plus prononcée; par son dernier tour de spire, qui égale le tiers de la longueur et qui ne le dépasse point comme dans l'*xiguum*.

**CARYCHIUM EUPHEUM.** Testa vix rimata, elongato-turrita, hyalina, lævi; spira acuminato-acutiuscula; anfr. 5 convexiusculis; ultimo  $\frac{1}{3}$  longitudinis superante; apertura parum obliqua, oblonga; pariete aperturali denticulo mediano adornato; peristomate leviter labiato, reflexo; margine externo intus inflexo.

Coquille allongée, turriculée, hyaline, lisse, à peine pourvue d'une

fente ombilicale. Spire acuminée, aiguë. Cinq tours un peu convexes, dont le dernier surpasse le tiers de la longueur totale. Ouverture peu oblique, oblongue ; paroi aperturale munie, vers le milieu, d'une seule denticulation assez forte. Péristome légèrement bordé et assez réfléchi. Bord extérieur infléchi en dedans.

Long.  $1\frac{3}{4}$  de mill. ; diam.  $\frac{3}{4}$  mill.

Habite les États-Unis d'Amérique.

Le *Carychium euphæum* peut être rapproché des *Carychium existelium* et *exiguum*.

1°. On le distinguera de l'*existelium* à sa taille plus faible, à sa spire plus aiguë, à son ouverture proportionnellement plus dilatée, à sa paroi aperturale ornée, vers son milieu, d'une petite denticulation ; à son péristome plus réfléchi et plus épaissi, etc. ; enfin à ses cinq tours de spire, etc. etc.

2°. On le séparera de l'*exiguum* à sa taille également plus faible, à son ouverture munie seulement d'une seule denticulation, tandis que celle de l'*exiguum* en possède deux, à son péristome plus épaissi, plus réfléchi, à sa spire plus aiguë, etc. etc.

#### SPURIOUS SPECIES.

*Carychium armigera*, *contracta*, and *rupicola* of Say (l. c.) are now ascertained to be true *Pupæ*, as he suggested they might be ; as is also *Carychium corticaria* Ferussac, (Tabl. Syst.)

#### PNEUMONOPOMA.

The above named order includes all the following families. The animals which compose it are distinguished from those of the preceding families of *Limacea*, *Helicea*, and *Auriculacea*, by the presence of an operculum, which is affixed to the foot and covers the aperture of the shell when they are withdrawn in it. They are terrestrial, breathing air by means of organs analogous to lungs. They are also unisexual, and have but two contractile instead of retractile tentacles, at the base of which are situated two eyes. The mantle is sometimes, though not always, free.

This order is made well known by the genera *Cyclostoma* and *Helicina*. It contains many other foreign genera, but these two and *Truncatella* are the only ones inhabiting the United States.

It is divided by Pfeiffer into two suborders: *Opisophthalma* and *Ectophthalma*, respectively characterized by the eyes being placed behind the base of the tentacles, and at their external base. The

#### SUBORDER OPISOPHTHALMA

is characterized as above, and contains one family only, the

#### FAMILY ACICULACEA.

In addition to the characters of the order, it has a thin spiral operculum and few whorls. It contains the European genus *Acicula*, and the genus *Geomelania*, of Jamaica, as well as *Truncatella*, which last alone inhabits the United States.

#### GENUS TRUNCATELLA Risso.

*Shell* imperforate, but with an umbilical groove, cylindrical, turretted, usually pellucid and smooth, of a reddish horn-color; the upper whorls are also truncated in the adult, the remaining ones are usually gradually increasing in size, and covered with more or less strongly developed ribs. The peristome is simple or double, sometimes reflected; the base is generally furnished with a prominent carina or ridge, formed by the peristome. The operculum is horny, hardly spiral, with a basal nucleus.

*Animal* with a small foot, against the end of which rests the operculum when the animal is withdrawn; the tentacles are short, acute; the snout is extended beyond them as much as the whole length of the animal. The shell is carried horizontally. The other characteristics of the genus are the same as those of the order and suborder. The animal lives in close proximity to the sea.



A figure of the animal as it appears while in motion is given on pl. 75, fig. 11, taken from Adams's Genera of Recent Mollusca. It represents a species not found in our country.

The animal walks by contracting the space between its lips and foot, like the geometric caterpillars.

*Remarks.* This genus has been but little understood by authors until the most recent investigations have proved it to belong to the same group as *Helicina*, *Cyclostoma*, &c. It has formerly been referred to the following genera:—*Truncatula*, *Fidelis*, *Choristoma*, *Erpetometra*, *Helix*, *Turbo*, *Cyclostoma*, *Acmea*, *Paludina*, *Pyramidis*, *Rissoa*, and *Turritella*. A full description of it will be found in the works of Pfeiffer referred to.

At first sight it seems almost impossible to admit of more than one species among the shells I have received from Florida. However well marked may be some individuals, when separately compared, there seem to be many others forming a chain of connection between them. I have, however, sent to Messrs. Pfeiffer and Poey our Florida specimens, and have received from them the decisions regarding their identity which I give below.

In all cases I have given Pfeiffer's Latin description of the species, and the figure of it to which he refers.

#### TRUNCATELLA CARIBÆENSIS SOWERBY.

PLATE LXXV. FIGURES 2, 4.

*T. subrimata*, subcylindrica, parum attenuata, solidula, rubella, succinea vel flavida, subtiliter costulata; costulis subrectis, sæpe in medio anfractuum evanescentibus; sutura lævis; anfr. superst. 3–4, sensim accrescentes, parum convexi, ultimus sæpe lævigatus, basi breviter carinato-cristatus; apertura subverticalis, ovali-elliptica, supernè angulata; perist. continuum, rectum, ad anfractum penultimum et in angulo insertionis incrassatum. (Pfr.)

#### SYNONYMS AND REFERENCES.

*Truncatella Caribæensis* SOWERBY, MSS.

*Truncatella Caribæensis* REEVE, Conch. Syst. 11, t. 182, fig. 7.

PFEIFFER in Zeitsch. f. Mal. 1846, p. 182; Mon. Auric. Viv. ii. 185; Mon. Phan. Viv. ii. p. 7.

CHEMNITZ, ed. 2; Auric. p. 9, pl. i. figs. 35, 36; pl. ii. fig. 22; non pl. ii. figs. 2-4.

*Truncatella Gouldii* ADAMS, ined.

*Truncatella succinea* ADAMS, Proc. Bost. Soc. 1845, p. 12.

#### DESCRIPTION.

*Animal* not observed.

*Shell* subperforated or grooved, subcylindrical, rather solid, in its truncated state but slightly decreasing in size towards the apex, reddish, or dark amber-colored, with delicate ribs, which are but little curved, and often hardly perceptible on the middle of the whorls; suture slight; whorls not truncated, three or four, distinctly increasing in size, equally convex, the last often smooth, slightly carinated on its base; aperture subvertical, ovally elliptic, angular above; peristome continuous, straight, thickened at its connection with the penultimate whorl.

Length, 7-8; diameter, 3 millimetres. Length of aperture,  $2\frac{1}{2}$  millimetres.

*Geographical Distribution.* Found among fine drift-wood, sand, and marine shells received from the Florida Keys. Is also quoted from Mexico and Alabama by Küster (Chemn. ed. 2), and from Cuba and Jamaica by Pfeiffer.

*Remarks.* This species shares the variations common to the genus. Its ribs are hardly as strongly developed as those of *bilabiata* and *pulchella*, nor are its whorls as convex. It is more nearly allied to the following species with which it appears to be confounded by Küster.

Both of my figures are from Chemnitz, fig. 2 representing the base of the shell.

#### TRUNCATELLA SUBCYLINDRICA GRAY.

PLATE LXXV. FIGURES 5, 6, 8.

T. vix rimata, cylindrica, costulis confertis regularibus, vel ad suturam

modo conspicuis, vel evanescentibus munita, nitida, pellucida, corneo-flava vel hyalina; anfr. superst. 4 convexiusculi, medio planati, regulariter accrescentes, ultimus basi non cristatus; apertura verticalis, ampla, angulato-ovalis, basi subeffusa; perist. leviter incrassatum, margine externo subproducto, columellari breviter reflexo, adnato et supernè incrassato. (Pfr.)

## SYNONYMS AND REFERENCES.

*Helix subcylindrica* PULTENEY, Cat. Dorsetsh. p. 49.

MONTAGU, Test. Br. ii. p. 393.

*Truncatella subcylindrica* GRAY in Turton's Man. p. 22, f. 6.

SHUTTLEWORTH, Diagn. 7, p. 154.

PFEIFFER, Mon. Auric. Viv. 187; Mon. Phan. Viv. ii. 7.

ORBIGNY, Moll. Cub. ii. p. 5, (excl. *T. truncatula*.)

*Truncatella truncatula* LOWE, in Zoöl. Proc. 1845, p. 217?; in Zoöl. Journ. V. p. 299, tab. 13, figs. 13-18.?

*Truncatella Caribæensis* PFEIFFER in Zeitsch. f. Mal. 1846, p. 182, ex parte.

KÜSTER in Chemn. ed. 2, Auric. pl. ii. figs. 1-4.

## DESCRIPTION.

*Animal* not observed.

*Shell* scarcely perforated or grooved, cylindrical, with crowded numerous ribs, sometimes quite imperceptible, and sometimes perceptible at the suture alone, shining, pellucid, light horn-color; four remaining whorls, rather convex, flattened at the middle, regularly increasing, the last one not prominently carinated at its base; aperture vertical, large, oval, with an angle above, spreading below; peristome slightly thickened, its outer margin slightly drawn out, reflected at the columellar, and thickened.

Length, 5; breadth, 2 millimetres. Aperture 2 mill. long.

*Geographical Distribution.* Found among rubbish from Florida Keys. Also is a common West Indian species.

*Remarks.* I have given the figure from Chemnitz to which Pfeiffer refers. Küster confounded it with the preceding species, from some forms of which it appears very difficult to separate it. Orbigny refers it to *T. truncatula*, a species described by Lowe from Madeira.

The shell of which the base is given (fig. 8) was found

in Florida, and having been referred to Pfeiffer for identification, was returned with the name of *subcylindrica*.

Its accidental introduction into England accounts for its presence in the English works above referred to.

The base is not furnished with the prominent ridge or carina.

### TRUNCATELLA BILABIATA PFEIFFER.

PLATE LXXV. FIGURES 3, 7.

*T. subrimata*, cylindræa, gracilis, solida, opaca, fusca, costulata; costis subarcuatis, elevatis, obtusis, interstitia æquantibus; sutura profunda, simplex; anfr. superst.  $4\frac{1}{2}$ –5 convexi, ultimus vix longior, basi subcompressus, callosus; apertura verticalis, ovalis, supernè vix angulata; perist. duplex; externum album, callosum, patens, in cristam basalem transiens, internum continuum, breviter porrectum. (Pfr.)

#### SYNONYMS AND REFERENCES.

*Truncatella bilabiata* PFEIFFER in Wieg. Arch. 1840, i. 253; in Zeit. f. Mal. 1846, p. 187; Mon. Auric. Viv. 192; Mon. Pneum. Viv. ii. 8.

CHEMNITZ, ed. 2, p. 7, pl. 1, figs. 27–31.

#### DESCRIPTION.

*Animal* not observed.

*Shell* subperforated or grooved, cylindrical, elegant, solid, opaque, brownish; ribs subarcuate, elevated, obtuse, at equal distances; suture deep and simple; remaining whorls  $4\frac{1}{2}$  to 5, convex, the last scarcely longer than the others, heavy and subcompressed at base; aperture vertical, oval, scarcely angular above; peristome double, the outer one white, heavy, and terminating in the basal ridge or carina, the inner one continuous.

Length  $5\frac{1}{2}$ , breadth  $1\frac{3}{4}$ , length of aperture  $1\frac{1}{2}$  millimetres.

*Geographical Distribution.* Found with the preceding species; also in Cuba (Pfeiffer), and on Carmen, an island of the Gulf of Mexico (Küster).

*Remarks.* The duplicated peristome and highly devel-



oped basal ridge or carina are the characteristics of this species.

Both of the figures are from Chemnitz. Pfeiffer refers to them as representing his species.

### TRUNCATELLA PULCHELLA PFEIFFER.

PLATE LXXV. FIGURES 1, 9, 10.

*T. subrimata*, oblongo-subcylindrica, gracilis, rufo-cornea vel succinea, rarius hyalina, nitida, subpellucida, subtiliter costulata; costulis vix elevatis, filiformibus, interstitia non æquantibus, ad suturam mediocrem sæpe distinctioribus; anfr. superst. 4-4½ modice convexi, lente accrescentes, ultimus infra medium plerumque lævigatus, basi breviter compresso-carinatus; apertura subverticalis, oblique fere elliptica, basi subeffusa; perist. simplex, continuum, expansiusculum, margine dextro crista levissima cincto. (Pfr.)

#### SYNONYMS AND REFERENCES.

- Truncatella pulchella* PFEIFFER, in Wieg. Arch. 1839, i. 356; in Zeitsch. f. Mal. 1846, p. 186; in Mon. Auric. Viv. 192; Mon. Pneum. Viv. ii. 8.  
SHUTTLEWORTH, Diag. 7, p. 155.  
CHEMNITZ, ed. 2, Auric. 10, pl. ii. figs. 11-15.

#### DESCRIPTION.

*Animal* not observed.

*Shell* subperforated, or grooved, oblongly subcylindrical, light, reddish horn-color or amber, shining, pellucid, lightly ribbed; ribs scarcely elevated, threadlike, at irregular intervals, often more distinct at the moderate suture; remaining whorls 4 to 4½, rather convex, gradually increasing in size, the last generally smooth below the middle, compressly carinated at its base; aperture subvertical, obliquely elliptical, enlarging at base; perist. simple, continuous, somewhat expanding, and furnished with a slight ridge at its right extremity.

Length 4½-5, diameter 1½-2, length of aperture 1⅔ millimetres.

*Geographical Distribution.* I detected specimens of

this West Indian shell among small shells collected by Mr. Bartlett in Florida.

*Remarks.* Instead of figuring American specimens, I have preferred giving a fac-simile of the figures referred to by Pfeiffer. Fig. 1 is, however, from one of our specimens.

Pfeiffer mentions a variety unknown to me, "*distinctius costata, peristomate subduplicata*."

It seems nearest allied to the preceding species, and admits of no little variation.

#### SUBORDER ECTOPHTHALMA.

Eyes at the side of the head at the external base of the tentacles; foot subelongate; operculum horny or testaceous, not concentrically striate, and not always distinctly spirated. (Pfr.)

It contains two families, *Cyclostomacea* and *Helicinacea*, which Binney united in the family *Helicinadæ*.

#### FAMILY CYCLOSTOMACEA.

In addition to the characters of the suborder, Pfeiffer enumerates these: "whorls numerous and subequal, or few and rapidly increasing."

#### SUBFAMILY CISTULEA.

Operculum suboval, cartilaginous, with few whorls and excentric nucleus; shell globose conic or ovate-turrit. (Pfr.)

#### GENUS CHONDROPOMA PFEIFFER.

Operculum oval, subcartilaginous, flat, with few, rapidly increasing whorls, and a nucleus generally very excentric. Shell oblong-turrit, generally truncated at tip, more rarely globosely conic; aperture oval; peristome simple,

or more or less thickened, straight, expanded or widely reflected. (Pfr.)

The only species of the old genus *Cyclostoma* found in this country belongs to *Chondropoma*, and not to *Cyclostoma*, as restricted by Pfeiffer, as stated by Gould on p. 349. Other species are found in the West Indies.

**CHONDROPOMA DENTATUM** SAY..vol. ii. p. 348, pl. lxii. lxxv. fig. 24.

*Cyclostoma dentatum* SAY, (Binney's ed.) p. 29.

*Chondropoma dentatum* PFEIFFER, Mon. Pneum. Viv. i. 286; ii. 140; Malak. Bl. 1856, p. 132.

GRAY and PFEIFFER, Brit. Mus. Phan. 203.

A view of the animal, twice its natural size, is given on pl. 75, fig. 24.

It will be noticed that I have omitted from the synonymy the West Indian species *C. lineolatum*, *crenulatum*, *Auberianum*, and *lunulatum*. It is at present impossible to speak with certainty about their identity with *dentatum*. Poey removes it from his Cuban Catalogue, (Mem. i. 393.)

It is worthy of note that Orbigny describes *Auberianum* as having equal transverse and longitudinal striæ. A reference to the enlarged figure of the surface shows a very different case in *dentatum*.

#### SPURIOUS SPECIES.

*Cyclostoma Cincinnatensis* Lea and DeKay, and *C. lapidaria* Say, Linsley, and Kirtland, are species of *Amnicola*.

*Cyclostoma marginalis* Kirtland, (Ohio Rep.) and *C. marginata* Say, are species of *Bulimus*.

*Cyclostoma tricarinata* Say is a *Valvata*.

#### FAMILY HELICINACEA.

Operculum without any vestige of a spiral form, testaceous, heavy or horny, thin, and furnishing no reliable

characters by which to designate and divide the several genera: semioval or triangular.

Pfeiffer gives these as additional characteristics to those of the suborder.

There are several genera comprised in the family, — *Alcadia*, *Trochatella*, *Lucidella*, *Stoastoma*, and *Helicina*, but the latter only has been found in this country.

For remarks on the animals of this family, see vol. ii. p. 350.

#### GENUS HELICINA LAMARK.

**HELICINA CHRYSOCHEILA** BINNEY. . . vol. ii. p. 354, pl. lxxiv. fig. 4.

*Helicina chrysocheila* PFEIFFER, Mon. Pneum. Viv. ii. p. 197.

I have in my cabinet my father's type of this species, and consider it distinct from *Hel. Jamaicensis* Sowb., and all other described species. I have a note taken by my father at the collection of M. Petit, in Paris, in which he says that a similar shell is labelled from Tampico.

In the collection of the Smithsonian Institute is an individual from Texas, (Würdemann.) It seems allied to *Hel. turbinata* Wieg.

Shuttleworth has used this name (1852) for another species, but has not priority.

#### **HELICINA HANLEYANA** PFEIFFER.

PLATE LXXV. FIGURES 14, 16.

T. globoso-conica, solidula, lineis concentricis impressis, subdistantibus sculpta, vix diaphana, nitida, fulvo-cornea; spira breviter conoidea, obtusiuscula; anfr. 5 vix convexiusculi, ultimus rotundatus, antice subdescendens; apertura parum obliqua, subsemicircularis; columella brevissima, extrorsum denticulata, callum tenuem, albidum, diffusum emittens; perist. album, vix expansiusculum, intus subincrassatum, basi in denticulum columellæ abiens. Operc. ? Diam. maj.  $7\frac{1}{2}$ , min.  $6\frac{1}{2}$ , alt.  $5\frac{3}{4}$  mill.

Habitat prope New Orleans (Sallé).



## SYNONYMS AND REFERENCES.

*Helicina Hanleyana* PFEIFFER, in Proc. Zöol. Soc. 1848, p. 122; Mon. Pneum. Viv. i. 376; ii. 203.

CHEMNITZ, ed. 2, p. 45, pl. ix. figs. 7, 8.

GRAY et PFEIFFER, Brit. Mus. Phan. p. 302.

*Remarks.* I have not seen this shell. The original description is given above, and a fac-simile of the figures from Chemnitz, ed. 2.

**HELICINA OCCULTA** SAY .....vol. ii. p. 356, pl. lxxiv. figs. 1, 2.

*Helicina occulta* SAY (Binney's ed.) pp. 36, 37, pl. xlv. figs. 4-6.

CHENU, Bibl. Conch. iii. p. 59, pl. xv. figs. 2 b, 2 c, 2 d.

DEKAY, N. Y. Moll. p. 82.

PFEIFFER, Mon. Pneum. Viv. i. 347; ii. 185.

CHEMNITZ, ed. 2, p. 18, (1846), pl. iv. figs. 11, 12, (1850).

GRAY and PFEIFFER, Brit. Mus. Phan. p. 250.

*Helicina rubella* GREEN, l. c.

This is probably the species referred to in Kirtland's Ohio Rep. p. 199 (1838).

I am inclined to consider *Hel. rubella* Green as a synonym of this species. From Sheboygan, Wisc., I have received an apparently recent specimen of it collected by Mr. Lapham. Green's description is as follows:—

**HELICINA RUBELLA.** Shell more than  $\frac{1}{4}$  inch broad, subglobose; spire slightly elevated, conical; whorls 5 or 6, with minute oblique striae; sutures slightly impressed; epidermis smooth and of a light brick-red color; aperture irregularly lunate, or semi-elliptical; outer lip white, callous, and partially reflected near the base; operculum corneous, smooth. Hills, western Pennsylvania.

**HELICINA ORBICULATA** SAY....vol. ii. p. 352, pl. lxxiii. lxxiv. fig. 3.

*Helicina orbiculata* SAY, (Binney's ed.) pp. 7, 36, pl. xlv. figs. 1, 2.

CHENU, Bibl. Conch. 3, p. 58, pl. xv. fig. 2, 2 a, 2 c.

DEKAY, N. Y. Moll. p. 82.

CHEMNITZ, ed. 2, p. 74, (1846), pl. x. figs. 32, 33.

PFEIFFER, Mon. Pneum. Viv. i. 375; ii. 199, (excl. *H. rubella*).

GRAY and PFEIFFER, Brit. Mus. Phan. p. 272, not of SOWERBY.

I adhere to the opinion expressed in vol. i. that *Hel. rubella* Green is identical with *Hel. occulta*, and not with this species. Pfeiffer follows the opinion of Gould.

The most northern locality at which this species has been found is Tennessee.

*Helicina orbiculata* Sowerby (Thes. Conch.) is not this species. Pfeiffer refers it to *Hel. nitida*, a Cuban shell.

*Helicina vestita* Guilding, in Sowerby's Thesaurus, No. 71, p. 14, tab. 1, fig. 42, appears to be the young of this species. Its description is copied by Pfeiffer, who was unacquainted with the shell (Mon. Pneum. i. 353). It is given below, while the figure is copied on my pl. 75, fig. 19.

H. VESTITA. T. globosa, tenui, concentricè lyrata, parva; apertura semi-lunari; labio externo tenui. Globose, thin, concentrically ribbed, small; aperture semi-lunar, outer lip thin. North America.

*Helicina castanea* Sowerby (l. c.) may also be an immature specimen of *orbiculata*. The figure of Sowerby is copied on pl. 75, fig. 20, and his description given below. Pfeiffer refers it to a variety of *Hel. subfusca* Menke (Mon. Pneum. i. 355).

H. CASTANEA. Guilding? T. *H. orbiculatæ* simili, sed lævi, depressa labio externo tenui.

Like *H. orbiculata*, but smooth and depressed, outer lip thin. North America.

Sowerby's figure of *Hel. minuta* is given pl. 75, fig. 18.

#### HELICINA TROPICA IAHN.

PLATE LXXIII. Middle fig. of lower line.

T. globosa, solida, lævigata, alba; spira fornicata, subacuminata; anfr. 5 convexiusculi, ultimus tumidus, anticè non descendens; apertura fere verticalis, subsemicircularis, multo altior quam lata; columella brevis, basi tuberculata, retrorsum in callum basalem diffusum, concolorum, antrorsum in peristoma crassum, reflexum, interdum duplicatim continuata. Operc.? Diam. maj. 8, min. 7, alt.  $6\frac{1}{2}$  mill. (Pfr.)

## SYNONYMS AND REFERENCES.

- Helicina tropica* IAHN in Chemnitz, ed. 2, p. 37, pl. iv. figs. 9, 10.  
 PFEIFFER, Mon. Pneum. Viv. i. 375; ii. 199.  
 GRAY and PFEIFFER, Brit. Mus. Phan. p. 271.  
 TROSCHEL, Gebiss d. Schn. p. 81, pl. v. fig. 9, (teste Pfr.)  
*Helicina Ambeliana* SOWERBY, Thes. Tab. i. fig. 19, nec ROISSY.

*Remarks.* The figure referred to is evidently this species, which is common in Texas. It appears to me to run imperceptibly into *Hel. orbiculata*, and will, in all probability, prove one of its many varieties. Indeed, Pfeiffer observes, "Ex icone Sayana hanc speciem sequenti (*orbiculatæ*) identicam suspicor."

*Helicina Ambeliana* Sowerby (not of DeRoissy) is referred to a "var.  $\beta$  flavida, vel rubella, interdum subfasciata," by Pfeiffer, to which also he refers Chemnitz's variety (fig. 22). Sowerby's figure is given (pl. 75, fig. 15), and his description here follows.

H. AMBELIANA. T. conica, lævi, spiraliter tenuissimè striata; apertura semi-lunari; labio externo crasso, reflexo, rotundato; operculo corneo.

Rather conical, globose, nearly smooth, with the aperture semilunar, and the outer lip thickened, reflected, and rounded; operculum horny. Antilles and Texas.

**HELICINA SUBGLOBULOSA** POEY.

## PLATE LXXV. FIGURE 17.

T. globoso-conica, solida, striatula, parum nitida, alba, unicolor, vel zonis 2 rufis ornata: altera lata prope suturam, altera angusta prope peripheriam; spira convexo-conica, acuminatiuscula; anfr. 6, primi planuli, penultimus convexior, subbiangulatus, ultimus subcarinatus, basi parum convexus; columella brevis, arcuata, sursum dilatata, linea impressa munita, callum emittens tenuem, diffusum; apertura parum obliqua, irregulariter semiovalis; perist. latum, angulatim patens, subexcavatum, ad utramque insertionem attenuatum. Operc.? Diam. maj. 10, min.  $8\frac{1}{2}$ , alt. 7 mill. (Pfeiffer.)

## SYNONYMS AND REFERENCES.

*Helicina subglobulosa* POEY, Mem. i. 115, 120, tab. xii. figs. 17-21.

PFEIFFER, Malak. Blatt. 1854, 107; 1856, 146; Mon.  
Pneum. Viv. ii. 209.

*Remarks.* This species is an inhabitant of Trinidad and Bayamo in Cuba. A single specimen, found at Key Biscayne, Florida, (Smithsonian Coll.) is figured on the plate, magnified to twice its natural size. Whether its introduction was but accidental, or whether it is well established in Florida, remains to be proved.

## SPURIOUS SPECIES.

*Helicina fastigiata* and *plicata* of DeKay (N. Y. Moll. p. 82) are respectively *Helix fastigiata* Say and *Helix Hazardi* Bland.

## ERRATA.

On page 2, line 34, for Fenessac read Ferussac.

- 5, " 39, " R. T. Shuttleworth read R. J. Shuttleworth.
- 10, " 6, " redimita read redemita.
- 48, " 9, " 7. read .7.
- 51, " 2, " its read it.
- 57, " 12, after 100) read ".
- 58, " 2, for odstricta read obstricta.
- 64, " 20, dele ?.
- 80, " 14, for connectans read connectens.
- 99, " 14, " isculis planu read planinsculis.
- 124, " 7, " limited read limital.
- 128, " 36, " consists read consist.
- 131, " 29, " 88 read 80.
- 133, " 2, " convexiusculis read convexiusculi.
- 135, " 10, " Macroceramus read Macroceramus.
- 138, " 32, " gracillmus read gracillimus.
- 166, " 16, dele !.



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     *divesta*, 51.  
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*florulifera*, 75.  
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*irrorata*, 124.  
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*Zilotea*, 32.



## EXPLANATION OF THE PLATES.

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### PLATE I.

Fig.

- 1 Base of *TRUNCATELLA PULCHELLA* Pfr.
- 2   "                   "           *CARIBÆENSIS* Sowb., from Chemn. pl. 2,  
fig. 22.
- 3 *TRUNCATELLA BILABIATA* Pfr., from Chemn. pl. 1, fig. 28.
- 4   "                   *CARIBÆENSIS* Sowb., from Chemn. pl. 1, fig. 36.
- 5   "                   *SUBCYLINDRICA* Gray, from Chemn. pl. 2, fig. 2.
- 6   "                   "           "   "   "   "   "   fig. 4.
- 7 Base of *TRUNCATELLA BILABIATA* Pfr., from Chemn. pl. 1, fig. 30.
- 8   "                   "           *SUBCYLINDRICA* Gray.
- 9 *TRUNCATELLA PULCHELLA* Pfr., from Chemn. pl. 2, fig. 12.
- 10   "                   "   "   "   "   "   pl. 2, fig. 13.
- 11 Animal of *TRUNCATELLA*, from Adams Gen. pl. 78, fig. 1.
- 12 *AURICULA CINGULATA* Pfr., from Orbigny pl. 13, fig. 8.
- 13   "                   "   "   "   "   "   pl. 13, fig. 9.
- 14 *HELICINA HANLEYANA* Pfr., from Chemn. pl. 9, fig. 7.
- 15   "                   *AMBELIANA* Sowb., Thes. Conch. pl. 1, fig. 19.
- 16   "                   *HANLEYANA* Pfr., from Chemn. pl. 9, fig. 8.
- 17   "                   *SUBGLOBULOSA* Poey — twice the natural size.
- 18   "                   *MINUTA* Sowb., from Thes. Conch. pl. 1, fig. 41.
- 19   "                   *VESTITA* Gould,   "   "   pl. 1, fig. 42.
- 20   "                   *CASTANEA* Gould,   "   "   pl. 1, fig. 32.
- 21 Animal of *MELAMPUS COFFEA* Lin., from Ad. Gen. pl. 82, fig. 7.
- 22   "                   *ALEXIA DENTICULATA* Mont.,   "   "   pl. 82, fig. 5.
- 23 *MELAMPUS BIDENTATUS* Say.
- 24 Animal of *CHONDROPOMA DENTATUM* Say — twice the natural size.
- 25 *MELAMPUS COFFEA* Lin., from Orbigny pl. 13, fig. 6.
- 27 Operculum of 24 — enlarged.

Fig.

29 MELAMPUS PUSILLUS Gmel.

30 MELAMPUS FLORIDIANUS Shuttl.

31 Enlarged view of head of HELICINA TROPICA Jan.

32 CARYCHIUM EXILE Lea, reduced view of aperture from Sill. Journ.  
42 l. c.

33 ALEXIA MYOSOTIS Drap.

34 LEUCONIA SAYII Kust., from Chemn. pl. 6, fig. 16.

## PLATE II.

1 HELIX ACUTEDENTATA.

2 " LOISA.

3 " AREOLATA Sowb. var. from Chemn. pl. 36, fig. 13.

4 " ARROSA Gould.

5 " ANACHORETA.

6 " CULTELLATA Thomson.

7 " NEWBERRYANA.

8 " PANDORÆ Forb., from Proc. Zool. Soc. 1850, pl. 9, fig. 3 b.

9 " DUPETITHOUARSI Desh., from Mag. Zool. 1841, pl. 30.

10 " LEVIS Pfr., from Chemn. pl. 36, fig. 16.

11 " AREOLATA Sowb., from Chemn. pl. 36, fig. 10.

12 " KELLETTI Forb., from Zool. Proc. 1850, pl. 9, fig. 2 b.

13 " ARBORETORUM Val., from Voy. de la Venus, pl. 1, fig. 3 a.

## PLATE III.

1 Enlarged view of epidermis of HELIX BARBIGERA Redfield, from  
N. Y. Lyc. vi. pl. 9, fig. 7.

2 HELIX BARBIGERA Redfield, from N. Y. Lyc. vi. fig. 4, 5.

3 " RÖMERI Pfr.

4 " ASPERSA Müll.

5 " DISSIDENS Desh., from Fer. pl. 84, fig. 1.

6-7 " MINUTISSIMA Lea — much enlarged.

8 " STRONGYLODES Pfr., from original specimen.

9 " ASTERISCUS Morse — very highly magnified.

10 " CLARKII Lea — twice the natural size.

11 " COOPERI — slightly enlarged.

12 " PUSTULA Fer., from pl. 50, fig. 1.



Fig.

- 13 *BULIMUS ZEBRA* Mull. var.
- 14 *HELIX VENTROSULA* Pfr.
- 15 " *SCULPTILIS* Bland.
- 16 " *HOPETONENSIS* Shuttl.
- 17 " *FABRICII* Beck, from Reeve, 1459 — magnified.
- 18 " *ELLIOTTI* Redf.
- 19 " *ANNULATA* Case, from Sill. Journ. N. S. iii. 101.
- 20 " *GRISEOLA* Pfr., from Chemn. pl. 60, fig. 17.
- 21 Variety of *GLANDINA TEXASIANA* Pfr. ?
- 22 *HELIX VIRGINALIS* Jan, from Chemn. pl. 38, fig. 19.
- 23 " *CEREOLA* Mühlf., from Berlin Mag. l. c.

## PLATE IV.

- 1 *HELIX ARIADNÆ* Pfr., outline of Chemn. pl. 65, fig. 31.
- 2 *HELIX DORFEUILLIANA* Lea, var. ? from N. Y. Lyc. vi. pl. ix. fig. 26.
- 3 Same as fig. 1, pl. 65, fig. 29.
- 4 " " aperture magnified.
- 5 *HELIX HINDSI* Pfr. — aperture magnified.
- 6 " " outline of Chemn. pl. 65, fig. 9.
- 7 *HELIX EDWARDSI* Bland, from N. Y. Lyc. vi. pl. ix. fig. 15.
- 8 Same as 6, pl. 65, fig. 8.
- 9 *HELIX EDWARDSI* Bland, from N. Y. Lyc. vi. pl. ix. fig. 16.
- 10 " *FASTIGIATA* Say — magnified four times, from N. Y. Lyc. vi. pl. ix. fig. 18.
- 11 " *TROOSTIANA* Lea " " " " pl. ix. fig. 23.
- 12 *BULIMUS ZEBRA* Müll. var. from Key Biscayne.
- 13 *HELIX HAZARDI* Bland, magn. 8 times from N. Y. Lyc. vi. pl. ix. fig. 27.
- 14 " *DORFEUILLIANA* Lea, magn. 4 times from N. Y. Lyc. vi. pl. ix. fig. 25 a.
- 15 " *RUGELI* Shuttl., magn. 4 times.
- 16 *PUPA GIBBOSA* Pfr., from Chemn. pl. 66, fig. 6.
- 17 *HELIX VOLVOXIS* Parr.
- 18 " *TEXASIANA* Mor. var. (triodonta Binn.)
- 19 " *HIPPOCREPIS* Pfr.
- 20 *PUPA HOPPII* Moll. from Chemn. pl. 19, fig. 30.
- 21 *HELIX THOLUS*.

Fig.

22 Animal of *HELIX VARIANS*.23 *HELIX MICRODONTA* Desh., from Fer. pl. 70, fig. 13.24 " *MOOREANA*.

## PLATE V.

1 *SUCCINEA LINEATA*.2 *HELIX INFUMATA* Gould.3 *BULIMUS FLORIDIANUS* Pfr., from original specimen.4 *HELIX MILIUM* Morse — very highly magnified.

5 " " " " " "

6 *MELAMPUS COFFEUS* Lin. var. ?7 *SUCCINEA RETUSA* Lea, from Phil. Tr. l. c. pl. 19, fig. 86.8 *MELAMPUS OLIVACEUS* Carpenter.9 *VITRINA ANGELICÆ* Beck — highly magnified.10 *HELIX BULBINA* Desh., from Fer. pl. 85, fig. 17.11 " *NEMORIVAGA* Val., from Voy. de la Venus pl. 1, fig. 1 a.12 *BULIMUS EXCELSUS* Gould, from Bost. Journ. 1857, pl. xiv. fig. 3.13 *HELIX DEVIA* Gould.14 *SUCCINEA RUSTICANA* Gould, from Ex. Ex. fig. 29.15 *BULIMUS CALIFORNICUS* Reeve, No. 378 — increased one half.16 Animal of *ALEXIA MYOSOTIS* Drap.17 *PUPA INCANA* Binn., var. fasciata.18 *SUCCINEA SALLEANA* Pfr. from Chemn.19 *ACHATINA CALIFORNICA* Reeve, No. 115 — natural size.20 *TRUNCATELLA CALIFORNICA* Pfr. — greatly enlarged.21 *HELIX MORMONUM* Pfr., from type.

22 Same as 20.

23 *CYLINDRELLA GOLDFUSSI* Mke. — twice the natural size.

## PLATE VI.

1 *BULIMUS ALTERNATUS* Say, var. ?2 *HELIX FRIABILIS*.3 *BULIMUS ALTERNATUS* Say, from his drawing.4 *SUCCINEA GRÆNLANDICA* Beck — enlarged.5 " *LINEATA*.6 *BULIMUS LIQUABILIS* Reeve, No. 387.

Fig.

- 7 *BULIMUS CONFINIS* Reeve, No. 643.
- 8 " *SCHIEDEANUS* Pfr. ? apice nigrâ.
- 9 *GLANDINÁ TRUNCATA* Gmel. var.
- 10 *BULIMUS DORMANI*.
- 11 *SUCCINEA INFLATA* Lea, from type.
- 12 " *EFFUSA* Shuttl. — enlarged.
- 13 *BULIMUS PATRIARCHA*.
- 14 *HELIX KOPNODES*.
- 15 *BULIMUS SCHIEDEANUS* Pfr. var. ? fauce nigrâ.















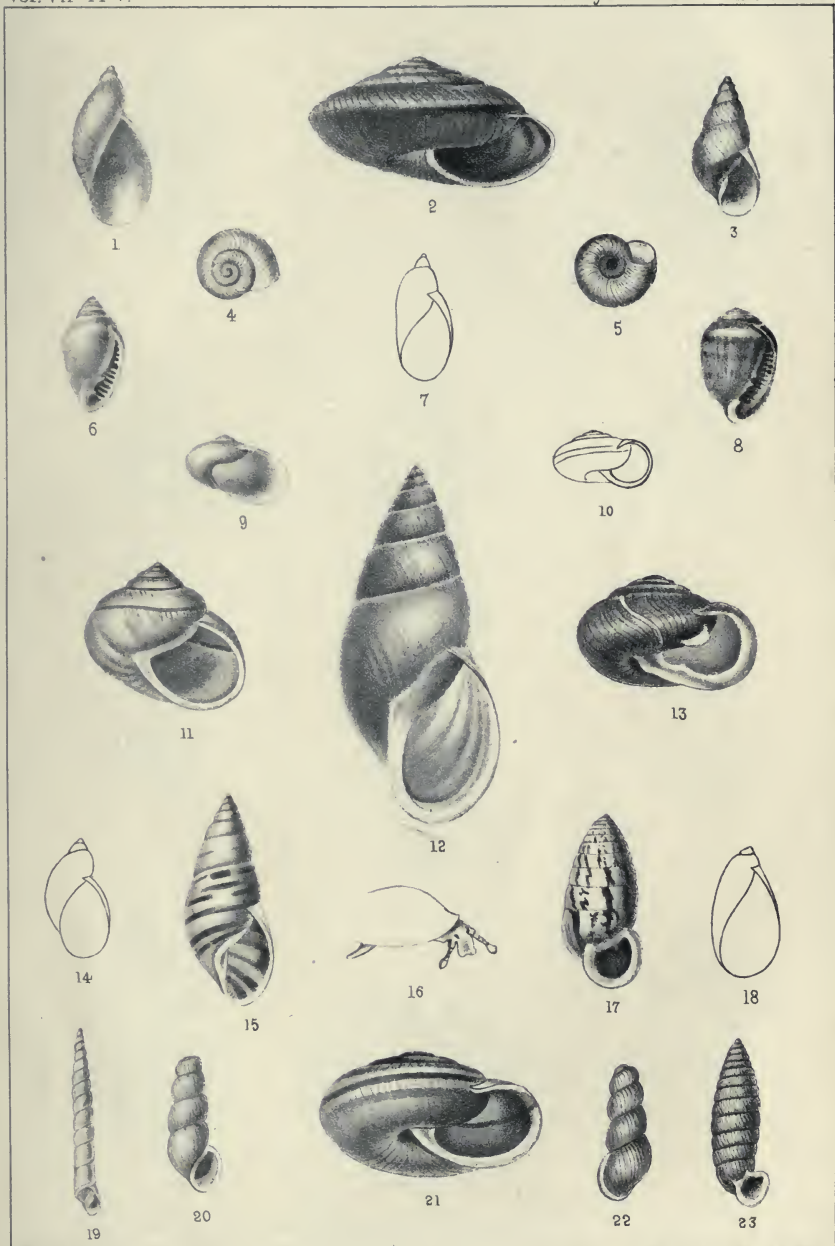
















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B O S T O N

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ART. II. — *Observations upon the Geology and Paleontology of Burlington, Iowa, and its Vicinity.* By CHARLES A. WHITE.

THE interest with which the lovers of geological science have come to look upon this locality, in consequence of its affording the greatest variety of Carboniferous fossils, in the most perfect state of preservation, and also of its exhibiting the junction of two of the great geological systems, the Devonian and Carboniferous, has made it desirable that a more detailed description of its rocks and their contents should be made known. This has been done to a considerable extent in the reports of Dr. D. D. Owen, and Prof. James Hall, and also in some degree by Dr. B. F. Shumard, and Messrs. Norwood and Pratten. But in consequence of the limited time that either of these gentlemen could give to any one locality, many of the details and minor facts were omitted, and among these are some which have since assumed more importance than they were formerly supposed to possess. Later discoveries, also, show an intimate and interesting relation to exist between the lower beds, which have upon the best author-

ity, and of late by general consent, been referred to the Chemung group of New York, and the beds of Carboniferous limestone overlying them. The earlier geological explorers of the northwest, referred the whole series of strata exposed here to the Carboniferous limestone. It is undeniable that a great proportion of the genera of the lower beds of the series are common to the mountain limestone; and also that many of the species have a close resemblance to others of that formation, particularly to the upper members of it, closer to these, in fact, than to any which are strictly referable to the Burlington limestone, between which and the lower beds a marked contrast is presented in their fossils when grouped separately. This general resemblance of fossils of known Devonian origin to others found in the Carboniferous rocks, and their gradual dying out and replacement by Carboniferous species, it is at present proposed to notice, together with other matters tending to show that in this locality at least the Carboniferous system was ushered in with the utmost tranquillity; the final change from Devonian to Carboniferous taking place so gradually as to render it impossible to point out the exact line where one ends and the other begins.

With the hope at a future time to make some comparisons between these rocks, and others holding a similar geological position in other localities, this communication will be mostly confined to a consideration of the strata exposed at Burlington, and traced above and below the city for several miles along the precipitous bluffs of the Mississippi River, and also the continuation of the same exposure, a few miles up each, on Skunk and Flint rivers, being an almost continuous exposure for about fifteen miles. It would have been desirable that the results of observations made at other localities of the same geological horizon should have accompanied these, yet it is

believed that the general conclusions drawn from observations made at this locality alone are fully warranted by the nature of the facts presented.

Descriptions of fossils from this locality have heretofore been in a great measure confined to the crinoidal and other forms from the Carboniferous limestone. This is, doubtless, attributable to the fact that the fossils in the lower beds, although abundant, are generally very badly preserved, while in the upper beds they are in great profusion and well preserved.

Late investigations have brought to light many fine and interesting fossils from the Devonian beds, giving promise that they will produce near a hundred species of shells, beside other fossils, making these strata likely to prove scarcely less interesting than the Carboniferous beds which overlie them. A great proportion of these shells are of undescribed species, and must doubtless long remain so, but it is a matter of congratulation that extensive collections of the fossils of the upper beds are in the hands of a paleontologist abundantly able to do them justice, and we may hope ere long to see descriptions of several hundred species of crinoids, alone, from this locality.

The following is a general section of the rocks exposed here, commencing at the level of the Mississippi River at its ordinary stage of water. From No. 1 to No. 6, inclusive, have been referred by Prof. Hall to the Chemung group of New York, and Nos. 7 and 8 to the Carboniferous limestone, and he remarks on page 91, vol. 1, of his Report on the Geology of Iowa, in relation to this locality, "the passage from the Chemung (Devonian) to the Burlington limestone (Carboniferous) is so gradual, both in physical aspect and the generic and specific characters of the fossils, that it forms no greater change than is observed between any of the subordinate groups, and is far less strongly marked than the change from Lower to Upper

Silurian, and not more strongly than between the Hamilton and Chemung." These remarks, together with giving the geological position of *Productus arcuatus* by the same author as "in limestone — below the Burlington limestone — of the age of the Chemung group," are the only intimations we have had that the fossils of the Chemung rocks here were recognized above bed No. 6.

## SECTION OF ROCKS EXPOSED AT BURLINGTON.

No. 1, arenaceous clay and fine-grained sandstone . . . . .	25 to 80 feet
No. 2, bluish gray limestone . . . . .	6 inches
No. 3, oölitic limestone . . . . .	3 "
No. 4, compact, fragmentary limestone . . . . .	7 to 12 feet
No. 5, fine-grained sandstone . . . . .	4 to 7 "
No. 6, oölitic limestone . . . . .	2 to 4 "
No. 7, brownish limestones and chert . . . . .	40 to 50 "
No. 8, grayish limestones . . . . .	20 to 40 "

The difference in the height of bed No. 1 above the level of the river, is due to a gradual dip of all the beds to the southward, and to very slight undulations; the beds of the whole series being quite conformable. The difference in the thickness of beds Nos. 7 and 8 is in a great measure due to denuding forces in operation previous to the deposit of the coal.

Beds No. 2, 3, 5, and 6 are supposed to be of limited extent; perhaps also bed No. 4, unless it should prove identical with the lithographic limestone of Missouri, which it very much resembles. At a point on Honey Creek, in Illinois, about ten miles from Burlington, the Burlington limestone is observed resting upon a fine-grained argillaceous sandstone of a visible thickness of about twelve feet, which is evidently either No. 5 considerably thickened, with No. 6 wanting, or No. 1, with the intervening beds to No. 7 wanting.

No. 1 is generally of a light, greenish blue, weathering to an ash gray, changing in color in different localities,



often suddenly and independent of stratification, yet also at times dependent upon it; and finally passes gradually upward into a yellowish, fine-grained sandstone. The lower parts, and particularly where it assumes a deep blue color, readily disintegrate into a soft, clayey material upon exposure to the atmosphere, but the upper parts are often solid enough to resist the action of the atmosphere and frost, and at one point it is quite calcareous and solid. This bed has formerly been divided into a lower bed of "blue, shaly clay" and an upper bed of "ash-colored grit-stones," but as the fossils found in the lower part are recognized in the upper part, and as no line of separation can be observed, the whole is considered here as one bed.

It is apparently composed of a blue, argillaceous material and fine yellow sand, with a limited amount of carbonate of lime as a cement. Where the argillaceous material predominates, the mass is of a blue color and rather soft. When the yellow sand and blue clay are more nearly equal, it assumes a greenish color and becomes harder. And when, as in the upper part, the yellow sand is in excess, and contains a greater amount of carbonate of lime, it becomes a yellowish sandstone. The changes of color, however, are not always entirely due to the mechanical mixture of the sand and clay. The fossils, with few exceptions, are in the form of casts; in the upper part they are generally abundant, but in the lower part they are rare, and are sometimes preserved in sulphuret of iron, the cavities which the fossils once occupied having been filled with this substance. In these parts, also, crystalline masses of bi-sulphuret of iron are often found.

Near one point, where this bed measures sixty feet above the level of the river, it has been bored for water to the depth of seventy feet below this level, without any apparent change in the character of the bed, and leaving an

unascertained depth below, as the boring did not reach through it. It is thus known in this locality to be more than one hundred and thirty feet thick.

No. 2 is a compact, bluish gray limestone, changing to a bluish brown. It is generally about six inches in thickness, but sometimes thins nearly out. It is not inclined to disintegrate or become fragmentary like bed No. 4, but breaks more easily in the plane of stratification than by cross-fracture. This is owing to the horizontal position of the shells, with which it is crowded to repletion. In consequence of the compactness of the stone, these shells, as well as all other fossils it contains, are badly preserved. The mineral composition, texture, and color, together with its abundance of fossils, are remarkably uniform.

No. 3 is a very thin band of oölitic limestone, seldom exceeding three inches in thickness. The egg-like concretions composing it are very distinct. Fossils are frequently found in it, but are not so abundant as in No. 2. Although so thin, it retains its place persistently throughout almost the entire exposure under consideration.

No. 4 is composed of a very compact, dark gray limestone, having a conchoidal fracture. It is thickly mottled with brown, sandy patches, harder than, but similar to, the stone of the overlying bed. The whole is very fragmentary, and, when exposed to the weather, falls into fragments similar in size to the stone used for macadamizing the streets. This bed has been pronounced unfossiliferous. In some places it is so, yet fossils are frequently found in it, but not abundantly. They are sometimes found congregated in small colonies, only a few feet in extent. Its lines of stratification are rather distinct, but the bedding is broken up by the fragmentary character of the mass. Zinc blende, in small lamellar and crystalline masses, is frequently found in it, as well as numerous cavities filled with calcareous spar.

No. 5 is a fine-grained sandstone, closely resembling the upper part of No. 1, and in hand-specimens it would be quite impossible to distinguish the difference. It is more evenly bedded than No. 1, and generally harder, having more carbonate of lime in its composition. It contains an abundance of fossils, but wholly in the form of casts. The cavities once occupied by the fossils are sometimes found partially filled with pulverulent carbonate of magnesia.

No. 6 is a light gray, oölitic limestone, with fossils quite plentifully and evenly disseminated through it, and varying but little in texture or color. In some places it is thinly and regularly bedded, but in others it presents quite a homogeneous aspect. The stone is of solid and good appearance when taken from the quarry, but breaks into small fragments upon exposure to the atmosphere and frost. The fossils are not often well preserved in this bed. Some of them have the appearance of having been partially dissolved. The stone also adheres firmly to the outer surfaces of them, and their cavities are frequently filled with calcareous spar, which separates into its component crystals, and destroys the fossil upon the first attempt to remove it. Small masses of zinc blende are also found here.

No. 7 may be described as generally a light reddish, or yellowish brown subcrystalline limestone, but is subject to many changes in color, texture, and composition, both dependent upon, and independent of, its stratification. For convenience of description it may be divided into lower, middle, and upper portions.

The lower portion, from five to ten feet above No. 6, is subject to fragmentary disintegration, and often leaves the mass above projecting to a considerable distance, until the weight becomes too great for its coherence to support, when it is broken off in large masses, and rolls to the foot to the bluff.



In this part it changes suddenly and without apparent cause from a tolerably pure limestone to that of a magnesian character, and again to a very porous, silicious stone, with numerous small cavities left by the decomposition of fossils, which usually have a drusy lining. In these parts the carbonate of lime is almost entirely wanting, and the fossils, with the exception of a few fish teeth, are found only as casts. In a few localities the mass becomes quite sandy, with barely enough carbonate of lime to serve as a cement to a part of it, leaving interstices filled with fine, incoherent sand. The causes which produced these lithological changes are not now apparent, yet, whatever they may have been, they seem to have had little influence on the fauna then living, as their fossil remains are found abundantly distributed through all.

This cannot be considered as a bed of passage, in the common acceptation of the term, from No. 6 to the middle portion of No. 7, as, beside presenting a well-marked line of division and lithological contrast, it is very fossiliferous, and contains the same species as the beds below, in as great, if not greater, abundance. Among its fossils are many forms of the most delicate corals and bryozoa, with crinoids of several genera and species. The whole gradually passes into the middle portion, without a definite line of separation, while the fossils of each are indiscriminately mixed, so that in the same mass we find fossils of known Devonian species, associated with others of not only Carboniferous types, but Carboniferous species,—the same species which continue without interruption through the Burlington limestone.

The middle portion of this bed, some ten or twelve feet in thickness, is a tolerably pure limestone, but in a few localities the irregular interstices between the purer layers of limestone are filled with a friable calcareous sandstone, changing to a fine, incoherent sand, similar to that of the



lower part. In these places the crinoids are remarkably well preserved, while most of the other fossils are in a bad state of preservation. What little calcareous matter the mass contains in these places seems to have been segregated in such parts as contained the crinoidal remains, solidifying these at the expense of the other parts.

The stone in this part of No. 7 is, to a great extent, composed of the remains of crinoids, more or less solidly cemented together, and apparently constitutes the entire vertical range of most of the species of these fossils found in it. Above this, it becomes interstratified with bands of chert, some of which reach a foot in thickness, and are quite continuous. Still farther upward, it passes into a yellowish or brown silicious shale. This is also interstratified with bands of chert and impure limestones, forming a bed of passage from No. 7 to No. 8. In some places, however, this bed of passage is made up principally of the cherty limestones, the silicious shale being but slightly developed.

The fossils in these chert bands are mostly in the form of casts, but are of the same species as those in the calcareous strata with which they are associated.

Although the introduction of silicious matter into the waters in which these rocks were deposited did not immediately affect the existence of its fauna, yet, from the time of the commencement of its deposit in any considerable amount, the species of crinoids in particular seem to have commenced dying out; and before the completion of this bed of passage, nearly or quite all of the species of crinoids, together with many of the species of shells found in the middle and lower portions of No. 7, ceased to exist. A very few species, principally of the Mollusca, survived this period, and flourished during the deposit of No. 8.

No. 8 is generally a light gray, semi-crystalline limestone, often changing to a color similar to that of No. 7, and in

hand-specimens cannot readily be distinguished from it. Some parts of this bed also are, to a great extent, composed of the remains of crinoids, nearly all the species of these fossils being peculiar to it, and generally ranging throughout its entire thickness. The limestone of this bed, even in its purest parts, contains a considerable admixture of silicious matter, the imbedded fossils being frequently quite silicified, especially near the exposed surfaces. It gradually becomes cherty in its upper parts, and finally passes into the chert bed of passage to the Keokuk limestone.

The following table will show the vertical range of some of the most conspicuous shells found in the series of rocks just enumerated, but more particularly those of the Chemung rocks.

The different beds are represented by columns, with numbers at their heads which correspond to those used in the preceding section. Asterisks in these columns opposite the name of each fossil show that it has been recognized in the beds which they represent. Their absence indicates only that it has not been so recognized.

The dotted line indicates the division between the lower and middle portions of No. 7. This dotted line represents in reality an *imaginary line* between the true Devonian and Carboniferous rocks; a line where Devonian species ceased only to predominate, and upward from which the Carboniferous species flourished in full force; the latter being often found below, and the former above, this line — that is, the Devonian species gradually die out, and are as gradually supplanted by Carboniferous species. So that this line between the two great systems is not so distinct as those between the different beds of the series here exposed, because the sudden lithological change which marks their separation is wanting here. A necessity exists for recognizing a line of this kind, and to which we must

extend the limit of the Devonian rocks, although the lithological appearances may not favor such a separation. Thus extended, they will embrace all the beds from No. 1 to the lower portion of No. 7, inclusive. The terms "upper beds" and "lower beds," as here used, refer respectively to the Carboniferous and Devonian rocks as thus defined. The names of fossils in *Italics* indicate that they are regarded as Devonian, while those in Roman letters show that they are considered as Carboniferous species.

TABLE SHOWING THE VERTICAL RANGE OF SHELLS.

		1	2	3	4	5	6	7	8
<i>Gyroceras Burlingtonensis</i> ,	Owen						*	.	.
<i>Euomphalus latus</i> ,	Hall						*	*	*
" <i>obtus</i> ,	"						*	.	.
<i>Spirifer plenus</i> ,	"						.	.	*
" <i>Grimesi</i> ,	"						.	*	*
" <i>extenuatus</i> ,	"	*			*	*	.	.	.
" <i>subrotundatus</i> ,	"	*			*	*	.	.	.
" <i>biplicatus</i> ,	"				*	*	*	.	.
" <i>Forbesi</i> ,	Norwood and Pratten						.	*	.
" <i>solidirostris</i> ,	White					*	*	.	.
<i>Nucleospira Barrisi</i> ,	White					.	.	.	.
<i>Athyris crassicaudalis</i> ,	White					*	*	.	.
" <i>incrassatus</i> ,	Hall					.	.	*	*
<i>Terebratula Burlingtonensis</i> ,	White					.	.	.	.
<i>Rhynchonella Missouriensis</i> ?	Shumard	*			*	*	.	.	.
" <i>pustulosa</i> ,	White		*		*	*	*	.	.
<i>Productus levicostus</i> ,	White	*				*	*	.	.
" <i>arcuatus</i> ,	Hall				*	*	*	.	.
" <i>Flemingi</i> , var. <i>Burlingtonensis</i> ,	Hall, var.						.	.	*
<i>Chonetes Logani</i> ,	Norwood and Pratten	*	*	*	*	*	*	*	*
" <i>Fischeri</i> ,	"	*	*	*	*	*	.	.	.
* <i>Strophomena rugosa</i> ,	Rafinesque	*			*	*	*	*	.
<i>Orthis inequalis</i> ,	Hall	*	*	*	*	*	*	.	.
" <i>Mitchellina</i> , var. <i>Burlingtonensis</i> ,	Hall, var.						.	*	*
" <i>Thiemei</i> ,	White		*	*	*	*	*	.	.
<i>Avicula circulus</i> ,	Shumard					*	*	.	.
<i>Cardiomorpha ovata</i> ,	Hall					*	.	.	.
" <i>rhomboidea</i> ?	"					*	*	.	.

\* While this paper is in course of preparation, a line from Mr. Worthen, the Illinois State Geologist, informs me that he also has recognized the shell given in the table as *Strophomena rugosa*, in the Encrinal limestone of Henderson and Warren counties of his state. The Rev. W. H. Barris has also placed in my hands some fossils from a locality near Indian town, Tama County, Iowa, among which are recognized *Euomphalus latus*, *Spirifer biplicatus*, *Strophomena rugosa*, *Terebratula Burlingtonensis*, and an *Orthis*, all of which are from the same rock there, and are also all found in the Burlington rocks, associated in like manner.



The preceding table shows that a few of the species are common to all the beds from No. 1 to the middle portion of No. 7, inclusive, and that other species commence below the upper limit of these, and range through both beds of Burlington limestone. In separating the fossils thus associated, we feel bound to consider those as Devonian species which have their origin and greatest development in rocks of known Devonian age, and are found above the proper limit of these rocks only in their decline. But we must, nevertheless, regard those species as Carboniferous which have their greatest development in Carboniferous strata, although they may have originated among Devonian forms.

This table will show, at a glance, how closely these Devonian and Carboniferous rocks are linked together by the association of their fossils; but it is not expected that it will give a full expression of the fossils of the whole series, or even of the shells alone. The shells here given are only those which are best known, while many other recognized species, not yet described, are omitted, among which are some that would perhaps illustrate still more fully the Chemung character of the lower beds than those enumerated.

The following table comprises a list of all the genera that have been recognized here; and, being arranged like the preceding one, will also show in which beds each genus has been recognized. This arrangement will show the generic relations of the upper and lower beds, but not their specific relations. Some of the genera are marked with an interrogation point, expressing doubt as to their identity, in consequence of the specimens being in a bad state of preservation. It is probable that other genera than those enumerated may yet be discovered.



A LIST OF THE GENERA DISCOVERED IN THE ROCKS AT BURLINGTON, SHOWING  
THE DIFFERENT BEDS IN WHICH THEY HAVE BEEN RECOGNIZED.

	1	2	3	4	5	6	7	8
<b>CRUSTACEANS.</b>								
Phillipsia.....							*	*
<b>CEPHALOPODA.</b>								
Gyroceras.....						*		
Orthoceras.....	*			*	*	*		
Phragmoceras?.....	*							
Goniatites.....	*							
<b>GASTEROPODA.</b>								
Porcellia.....	*							
Bellerophon.....	*			*	*	*		
Euomphalus.....		*			*	*	*	*
Pleurotomaria.....		*	*				*	
Murchisonia?.....		*	*	*				
Platyceras.....					*		*	*
Conularia (Pteropod).....	*							*
Loxonema?.....	*			*	*	*		
<b>BRACHIOPODA.</b>								
Spirifer.....	*	*	*	*	*	*	*	*
Athyris.....					*	*	*	*
Nucleospira.....						*	*	*
Retzia?.....		*				*	*	*
Productus.....	*			*	*	*	*	*
Lingula.....							*	*
Orthis.....	*	*	*	*	*	*	*	*
Chonetes.....	*	*	*	*	*	*	*	*
Strophomena.....	*				*	*	*	
Merista?.....					*	*	*	
Rhynchonella.....	*	*	*	*	*	*	*	
Terebratula.....						*	*	
Discina.....	*							
<b>LAMELLIBRANCHIATA.</b>								
Avicula.....	*	*			*	*	*	
Pecten.....	*				*	*	*	*
Aviculopecten.....	*				*	*	*	
Cardiomorpha.....					*	*	*	
Myalina?.....	*						*	
Modiolopsis?.....	*				*		*	
Edmondia?.....	*			*	*		*	
Nucula?.....	*				*		*	
Conocardium.....						*	*	
<b>ECHINODERMATA.</b>								
Actinocrinus.....						*	*	*
Agaricocrinus.....							*	*
Archicoidaris.....							*	*
Cyathocrinus.....							*	*
Codaster.....							*	*
Dichocrinus.....							*	*
Forbesiocrinus.....							*	*
Homocrinus.....						*	*	
Ichthyocrinus.....							*	*
Megistocrinus.....							*	*

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A LIST OF THE GENERA DISCOVERED IN THE ROCKS AT BURLINGTON, SHOWING THE DIFFERENT BEDS IN WHICH THEY HAVE BEEN RECOGNIZED.

(Concluded from preceding page.)

	1	2	3	4	5	6	7	8
Mespilocrinus .....							*	
Olivanites.....							*	*
Pentremites.....							*	*
Platycrinus.....						*	*	*
Poteriocrinus.....						*	*	*
Rhodocrinus.....						*	*	*
Scaphiocrinus.....							*	
Synbathocrinus.....							*	*
Spatangus?.....							*	
Trematocrinus.....							*	*
Zeacrinus.....							*	*
CORALS AND BRYOZOA.								
Chætetes .....							*	
Fenestella.....	*					*	*	*
Favosites.....		*						
Syringopora.....		*				*	*	
Striatopora?.....						*	*	*
Zaphrentis.....					*	*	*	*
Aulopora .....						*	*	*

The remains of fishes, particularly their teeth, are not unfrequently found in both the Devonian and Carboniferous strata. No classification of them has been attempted, but they are readily separable into three groups, the first belonging to the Devonian beds, the second to the lower bed of Burlington limestone, and the third to the upper bed.

Of Crustaceans, none but those belonging to the genus *Phillipsia* have been discovered. Three species of this genus have been recognized, two in the lower, and one in the middle portion of No. 7, and also in No. 8.

The Cephalopoda, so far as observed, are confined to the lower beds, and comprise but three or four genera.

The Gasteropoda are quite numerous, both in genera and species, but are most abundant in the lower beds.

The Brachiopoda are the prevailing forms in the lower beds, and are numerous in genera, species, and individuals.

The Lamellibranchiata, with but few exceptions, have not been observed above the base of No. 7. One of these is a *Pecten* in No. 8, another a *Pecten* in the lower portion of No. 7, and another is the *Avicula circulus* of Shumard, which is also found in the lower portion of No. 7. In some of the lower beds, the Lamellibranchiata are almost as numerous as the Brachiopoda.

The Crinoida are the prevailing forms in the upper beds, which present, in this respect, a striking contrast to the lower beds. Portions of crinoidal stems have been found in all the lower beds, but no parts of their bodies have been observed below No. 6. In this bed, the genera *Platycrinus*, *Rhodocrinus*, and *Actinocrinus* have been recognized by the discovery of fragments of their bodies. In the lower portion of No. 7 the same genera have been recognized, with the addition of *Poteriocrinus*, *Homocrinus*, and *Pentremites*. Their remains are far more abundant here than in the beds below, but less so than in the upper beds. Of other Echinodermata, at least two species of *Archiocidaris* have been discovered; one in the lower and middle portions of No. 7, and another in No. 8. A species of *Spatangus*? has also been recognized in the middle portion of No. 7.

By taking the foregoing view of the proper separation of the fossils of these rocks, it will be found that the number of species of the Brachiopoda formerly considered as Carboniferous is considerably reduced. From present indications, it is thought that there are but some ten or twelve true Carboniferous species of this order in the upper beds, the greater portion of which are published by Prof. Hall in the Iowa Reports.

The peculiarities of these, as compared with those of the lower beds, are easily recognized. The genera are of larger size, respectively, and the Spirifers, in particular, are of more compact and rounded forms, and are destitute

of those mucronate hinge extremities so common to the Devonian Spirifers. The *S. Forbesi* approaches the latter form most nearly, but it reaches its greatest development but a few feet above the range of Devonian fossils, and perhaps should be considered as an intermediate species.

By this separation of the fossils of the Burlington rocks, the Brachiopods of the lower beds are found to bear less general resemblance to those of the Burlington limestone, immediately overlying them, than they do to those of almost any other member of the Carboniferous limestone series, notwithstanding the fact that the Chemung and Burlington limestone beds are otherwise so intimately related. Indeed, quite a number of species could be selected from the Brachiopods of the Chemung beds at Burlington, that bear so close a resemblance to others of the upper members of the Carboniferous limestone as to require considerable acquaintance with them to distinguish their differences.

The contrasts and similarities above mentioned seem to have taken place without any particular regularity or gradation, but by comparing the Crinoida of the lower and upper beds of Burlington limestone, together with those of the Keokuk limestone, we find that they present three successive grades of development, which, commencing in conjunction with Devonian forms, furnish other links by which the Devonian rocks are connected with the Carboniferous. The crinoids of the lower bed of Burlington limestone are generally of smaller size than those of the upper bed, and have a delicacy of construction and surface-marking and ornament, together with a pleasing symmetry of outline, which present quite a contrast to those of the upper bed, when considered in the aggregate.

Those of the upper bed are generally of stronger construction and ruder form, and have a coarser style of ornament.



In the Keokuk limestone, they reach a culmination of rudeness and extravagance of form, which constitute a prominent feature of most of the genera found in that rock.

Few if any species of these fossils are common to both beds of the Burlington limestone, as before remarked, and it is hardly probable that any will be found to be common to the Burlington and Keokuk limestones, yet all the genera discovered in the three beds are common to all, except the genera *Codaster* and *Spatangus* (?), which have been found thus far only in the Burlington limestone. There are, moreover, certain groups, or subdivisions of the more prominent genera, that comprise species from each of the three beds.

The conformity of all the beds exposed at Burlington, together with the uninterrupted range of the fossils of the lower beds until they reach a point in No. 7 where they are gradually displaced by the Carboniferous species, without any abrupt change in the lithological character of the imbedding rock, seems to preclude the possibility of a hiatus existing between the Devonian and Carboniferous beds. From the evidence which the rocks themselves present, backed by the opinions of the best geologists of the country, we feel as much warranted in referring the lower beds to the Chemung group of New York, as we do in referring the upper ones to the Carboniferous limestone; notwithstanding the fact that another member of the Devonian system overlies the Chemung group in New York, the thickness of which is greater than that of the entire development of both the Devonian and Carboniferous systems in the Mississippi Valley, and underlies the rocks which are there considered the equivalent of the Carboniferous limestone of the West.

An interesting question thus presents itself as to the actual equivalency of these rocks, which it is not proposed

at present to discuss, but a suggestion may not be out of place. Admitting that some of the species found in the lower beds have been identified with those of the Chemung group of New York, it settles beyond question their geological equivalency, but does not necessarily prove that they were contemporaneous. Indeed, it seems probable that they were not so, by an interval of the time that it would take the species to migrate that distance. May it not, therefore, be inferred that the species originated at the east, and were migrating westward during the time that the bottom of the Chemung seas was sinking, and receiving upon it the deposit of the Old Red Sandstone,—thus making these Devonian rocks equivalent to the Chemung of New York, and contemporaneous, at least in part, with the Old Red of the Catskill Mountains?

*Descriptions of seven new Species of Brachiopoda from the Chemung Rocks at Burlington, Iowa.*

RHYNCHONELLA PUSTULOSA (WHITE.)

Shell subtrigonal, or subglobose, front broadly rounded, or slightly flattened, sides flattened and meeting at the beak at nearly a right angle. Dorsal valve much more convex than the ventral valve, which is usually somewhat depressed. Beak closely incurved. Highest part, near the front margin. Beak of ventral valve prominent, acute, and considerably incurved; foramen triangular.

Surface marked by from twelve to sixteen strong, somewhat rounded plications, three of which are usually moderately depressed on the ventral valve, and four elevated on the dorsal valve, forming the mesial fold and sinus, which are not observable much more than half the length of the shell. Along the centre of each of the plications, for a

considerable distance from the margin, runs a slight depression, giving them a flattened appearance.

Fine concentric striæ and imbricating lines of growth are visible on well-preserved specimens. Where the shell is partially exfoliated, it usually presents under the lens a fine pustulose appearance.

Length six lines, breadth seven lines.

*Geological formation and locality.* In beds Nos. 1, 2, 3, 4, 5, 6, and the lower portion of No. 7, of the preceding sections, Burlington, Iowa.

NUCLEOSPIRA BARRISHI (WHITE.)

Shell transversely oval, gibbous, becoming ventricose with age. Hinge-line short, surface traversed by a few imbricating lines of growth, which increase in number near the border in the older specimens. Ventral valve with a narrow, faintly impressed sinus extending from the beak along the shell, corresponding to the inner septum, which gradually expands into a broader and deeper depression, and, with a corresponding elevation in the opposite valve at the margin, gives it considerable sinuosity in front. Beak short, acute, and slightly incurved. A minute, round foramen just beneath the apex.

False area small, concave. Longitudinal septum not extending beneath the beak, but ending about even with the cardinal teeth. Dorsal valve more gibbous than the ventral, umbo prominent, longitudinal septum extending the full length of the shell, but becoming indistinct at the front margin. A narrow, scarcely perceptible impression extends along the back, opposite the septum. The spatulate portion of the cardinal process short, and bending slightly upward, to correspond to the under side of the concave area, beneath which it passes at nearly a right angle to the basal portion. The crura, being very small, serve to

give sharpness to the angle, and also, by slight lateral projection in front of the cardinal teeth, gave security to the hinge. Length from four to five lines, breadth from five to six lines.

*Geological formation and locality.* In the lower portion of bed No. 7 of the preceding sections, Burlington, Iowa, where it is rare.

The discovery of a species of this interesting genus, established by Prof. Hall in 1857, at the base of the Carboniferous system, materially extends the known geological range of the genus.

Dedicated to the Rev. W. H. Barris, rector of Christ Church, Burlington, Iowa.

TEREBRATULA BURLINGTONENSIS (WHITE.)

Shell rather small, longitudinally oval, gibbous or slightly compressed, broadest a little forward of the middle.

Ventral valve regularly convex, beak large, projecting considerably beyond the dorsal valve, incurved.

Hinge-line abruptly curved, deltidium in two pieces, truncated at the apex by the foramen, concave at the base to receive the beak of the dorsal valve. A faint, scarcely defined ridge on each side of the beak follows its curvature from the foramen, and finally loses itself at the margin, near the middle of the shell.

Dental plates strong, deep, and nearly perpendicular, bevelled backward, and presenting a sharp edge in front, tapering and projecting slightly above the margin.

Dorsal valve depressed convex, forming a sinuate juncture with the opposite valve at the sides of the shell, a little the most convex near the beak.

Beak broad, not incurved. Cardinal process consisting simply of a small projecting rim around the inside of the hinge-line, the ends of which incline inward from the mar-



gin, forming the dental sockets, which are open in front. Surface nearly smooth; only a few concentric lines of growth are observed upon the specimens obtained. It is not abundant.

*Geological formation and locality.* In the lower portion of bed No. 7 of the preceding sections, Burlington, Iowa.

ATHYRIS CRASSICARDINALIS (WHITE.)

Shell subquadrangular, or subcircular, more or less gibbous, greatest width usually above the middle, hinge-line broadly curved, equal to about half the width of the shell.

Ventral valve convex, beak small, curving upward, and meeting the beak of the dorsal valve. Teeth distant, pointing inward, and slightly upward and backward. Muscular impression rather large, suboval, extending to the beak without interruption. A faint longitudinal ridge is sometimes observed on the inside of the shell, running from beak to front, and a corresponding depression along the outside, which, with a similar depression on the other valve, give a slightly truncated or emarginate appearance to a narrow portion of the front margin. Dorsal valve depressed-convex, usually a little flattened at the sides below the hinge-line, much more convex longitudinally than transversely. Beak slightly prominent, meeting the under side of the beak of the opposite valve, and completing the foramen.

Muscular impressions occupying a long, narrow space, extending more than half the length of the shell. Hinge-plate strong, prominent, and compact, its muscular cavities distinct, more or less deeply notched in front, and perforated by a very minute foramen; on each side of it is an oval-shaped cavity of considerable depth for the reception of the teeth of the opposite valve, forming a pivot-hinge so perfect that the valves could not be separated

without breaking some of its parts. Surface marked by squamose lines of growth, and frequent lines of imbrication, particularly near the margin, proceeding from which occasional specimens show the remains of fringes of considerable length.

This species is somewhat variable, particularly in the convexity of the dorsal valve, and the prominence and curvature of the beaks. The ventral valve is considerably weakened by the large, deep, muscular impression, in consequence of which it is liable to be damaged or destroyed. The dorsal valve is stronger, and receives additional strength from its massive hinge-plate, and is consequently more frequently preserved.

The foramen of the hinge-plate, being so small, is usually filled, and not observable. Width a little greater than the length, seldom exceeding five lines.

*Geological formation and locality.* In Nos. 5, 6, and the lower part of No. 7, of the preceding sections, Burlington, Iowa.

#### PRODUCTUS LÆVICOSTUS (WHITE.)

Shell of medium size, somewhat ovoid in form, longer than wide, broadly expanding toward the front, moderately arcuate above, hinge-line less than the width of the shell in front, ears slightly projecting, strongly wrinkled. Dorsal valve following the curvature of the opposite one, and leaving a moderate space between them. Ventral valve regularly rounded, beak broad, short, slightly incurved over the hinge-line, strong wrinkles on the sides, extending out upon the ears, which, with the broadly rounded umbo, give these parts the appearance of having been pushed forcibly forward. Surface marked by numerous filiform costæ, of a smooth, wiry appearance, which increase by implantation, as the shell increases in size;

space between them less than their width. The implanted costæ increase very gradually, and sometimes irregularly, in size. The whole crossed by very fine, undulating, concentric striæ. On a narrow space along the cardinal border of the ventral valve the bases of numerous small, thickly-set spines are observed, but no indication of spines has been detected on other parts of the shell.

This species somewhat resembles the shell in the Kaskaskia limestone, usually referred to *P. Cora*, but differs from it in its less prominent and broader beak. The costæ are also coarser, smoother, and more rounded and elevated.

In consequence of the compactness of the imbedding stone, specimens are rarely found showing the full length of the hinge-line, or the expansion of the front.

*Geological formation and locality.* In beds Nos. 1, 5, 6, and the lower portion of No. 7, of the preceding sections, Burlington, Iowa.

ORTHIS THIEMEI (WHITE.)

Shell depressed, orbicular, usually a little wider than long, widest below the middle, hinge-line very short. Dorsal valve deeper than the ventral valve, regularly convex, with the general exception of a very shallow sinus extending from beak to front. Beak projecting a little beyond the hinge-line, and slightly curving toward the beak of the opposite valve. Cardinal process strong, with a strong, rounded septum extending from it nearly half the length of the shell. Brachial processes strong, notched at the ends. Margins crenulate more than half around the shell.

Ventral valve convex near the umbo, depressed in front, which, with the depression on the opposite valve, considerably flattens the front margin. Beak short, elevated, and

incurved, leaving but little space between the two beaks. Width and height of foramen about equal, nearly filled by the strong cardinal process.

Muscular cavity large, heart-shaped, with a forked septum occupying its centre. Surface marked by fine striæ, with occasional tubular openings on the surface. Striæ increasing by implantation, and gradually bending out toward the lateral margins.

Imbricating lines usually confined to a space near the margins. This shell is variable in the convexity of the dorsal valve, the distinctness of the dorsal sinus, and the strength of the cardinal and brachial processes. Width a little more than the length, usually less than half an inch.

In its details, this species considerably resembles the western forms of *Orthis Vanuxemi* of the Hamilton group, but, beside other differences, it is usually of smaller size, more gibbous, and the ventral beak is more elevated and incurved.

*Geological formation and locality.* In beds Nos. 1 to the lower portion of No. 7, inclusive, Burlington, Iowa. Dedicated to Dr. Otto Thieme, of Burlington, Iowa.

SPIRIFER SOLIDIROSTRIS (WHITE.)

Shell rather small, nearly semicircular, wider than long, widest at the hinge-line, where it is sometimes extended into submucronate points, rounded in front.

Dorsal valve more convex from beak to front than transversely. Beak scarcely prominent, slightly projecting beyond the hinge-line.

Ventral valve about twice as deep as the opposite one, regularly arcuate from beak to front, but a little depressed near the cardinal extremities. Area large and well defined, foramen narrow, beak acute, incurved, and becoming solidified as the foramen is progressively closed. Dental



plates strong, projecting a little forward of the hinge-line. From six to eight prominent plications on each side of the mesial fold and sinus, which decrease regularly in size toward the hinge extremities. Sinus rather broad and deep, distinctly defined even to the point of the beak; a slightly elevated ridge extends along its bottom, and a corresponding depression along the mesial fold.

Mesial fold prominent, and widely separated from the plications. Surface marked by fine, lamellose, concentric striæ, which arch upon the plications, and the ridge in the mesial sinus, and doubly arch upon the mesial fold.

*Geological formation and locality.* In beds Nos. 5, 6, and the lower portion of No. 7, of the preceding sections, Burlington, Iowa.

*List of described Fossils recognized in the Burlington Rocks.*

MOLLUSCA.

Gyroceras Burlingtonensis,	Owen,	Chemung.
Euomphalus latus,	Hall,	Carboniferous.
"    obtusus,	"	Chemung.
Spirifer Grimesi,	"	Carboniferous.
"    Forbesi,	Norwood and Pratten,	"
"    plenus,	Hall,	"
"    imbrex,	"	"
"    incertus,	"	"
"    subrotundatus,	"	Chemung.
"    extenuatus,	"	"
"    biplicatus,	"	"
Rhynchonella Missouriensis?	Shumard,	"
Athyris incrassatus,	Hall,	Carboniferous.
Orthis Swalovi,	"	"
"    Michelina, var. Burlingtonensis,	"    var.	"
"    inæqualis,	"	Chemung.
Chonetes Fischeri,	Norwood and Pratten,	"
"    Logani,	"    "    "	"
Productus arcuatus,	Hall,	"
"    Flemingi, var. Burlingtonensis,	"    var.	Carboniferous.
"    concentricus,	"	Chemung.
"    Shumardianus,	"	"

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Avicula circulus,	Shumard,	Chemung.
Cardiomorpha ovata,	Hall,	"
" ? rhomboidea,	"	"

### RADIATA.

Actinocrinus ventricosus,	Hall,	Carboniferous.
" discoideus,	"	"
" æqualis,	"	"
" umbrosus,	"	"
" longirostris,	"	"
" ornatus,	"	"
" turbinatus,	"	"
" " var. elegans,	"	"
" cœlatus,	"	"
" proboscidealisis,	"	"
" sculptus,	"	"
" verrucosus,	"	"
" multibrachiatus,	"	"
" pentagonus,	"	"
" cornigerus,	"	"
" trinodus,	"	"
" symmetricus,	"	"
" minor,	"	"
" superlatus,	"	"
" brevicornis,	"	"
" subaculeatus,	"	"
" tricornis,	"	"
" brevis,	"	"
" corniculus,	"	"
" pyramidatus,	"	"
" unicornus,	Owen and Shumard,	"
" multiradiatus,	Shumard,	"
" Vernerilianus,	"	"
" Konincki,	"	"
" Chrystyi,	"	"
" pyriformis,	"	"
" rotundus,	Yandell and Shumard,	"
Agaricocrinus stellatus,	Hall,	"
" bullatus,	"	"
Megistocrinus Evansi,	Owen and Shumard,	"
Synbathocrinus Wortheni,	Hall,	"
" dentatus,	Owen and Shumard,	"
Archiocidaris Agassizi,	Hall,	"
Rhodocrinus Wortheni,	"	"
Ichthyocrinus Burlingtonensis	"	"
Scaphiocrinus dichotomus,	"	"
" simplex,	"	"

<i>Zeacrinus ramosus</i> ,	Hall,	Carboniferous.
“ <i>elegans</i> ,	“	“
<i>Dichocrinus ovatus</i> ,	Owen and Shumard,	“
“ <i>striatus</i> ,	“ “ “	“
<i>Cyathocrinus Iowensis</i> ,	“ “ “	“
“ <i>cornutus</i> ,	“ “ “	“
“ <i>rotundatus</i> ,	Hall,	“
“ <i>divaricatus</i> ,	“	“
“ <i>malvaceus</i> ,	“	“
<i>Pateriocrinus calyculus</i> ,	“	“
“ <i>rhombiferus</i> ,	Owen and Shumard,	“
<i>Pentremites Norwoodii</i> ,	“ “ “	“
“ <i>melo</i> ,	“ “ “	“
“ <i>stelliformis</i> ,	“ “ “	“
“ <i>elongatus</i> ,	Shumard,	“
<i>Platycrinus Americanus</i> ,	Owen and Shumard,	“
“ <i>discoideus</i> ,	“ “ “	“
“ <i>planus</i>	“ “ “	“
“ <i>Burlingtonensis</i> ,	“ “ “	“
“ <i>corrugatus</i> ,	“ “ “	“
“ <i>Yandelli</i> ,	“ “ “	“
“ <i>nodobrachiatus</i> ,	Hall,	“
“ <i>nodosus</i> ,	“	“
“ <i>nucleiformis</i> ,	“	“
“ <i>canaliculatus</i> ,	“	“
“ <i>truncatus</i> ,	“	“
“ <i>truncatulus</i> ,	“	“
“ <i>subspinosus</i> ,	“	“
“ <i>sculptus</i> ,	“	“
“ <i>tuberosus</i> ,	“	“
“ <i>Shumardianus</i> ,	“	“
“ <i>Wortheni</i> ,	“	“
“ <i>pileiformis</i> ,	“	“
“ <i>pocilliformis</i> ,	“	“
“ <i>cavus</i> ,	“	“

*Fossils described in this Paper.*

<i>Spirifer solidirostris</i> ,	Chemung.
<i>Nucleospira Barrisii</i> ,	“
<i>Terebratula Burlingtonensis</i> ,	“
<i>Athyris crassiscardinalis</i> ,	“
<i>Rhynchonella pustulosa</i> ,	“
<i>Productus lævicostus</i> ,	“
<i>Orthis Thiemei</i> ,	

ART. III. — On the Hymenoptera of the Genus *Allantus* in the United States. By EDWARD NORTON.

[Read Dec. 5th, 1860.]

IN the following paper, I have endeavored to give a list of the known species of this genus, and to describe a number of new species. Through the kindness of Mr. S. H. Scudder, I have been enabled to identify most of those named by the late Dr. Harris in his "Catalogue of the Insects of Massachusetts" from the original specimens, now in the possession of the Boston Society of Natural History. Many of them were named by Say for Dr. Harris, but do not seem to have been described.

Some of the species here enumerated do not agree in every respect with the generic characters laid down by Hartig; the abdomen is not always as elongate, as in *A. Schrophulariæ*, nor the hind legs very long, but all have the third joint of the antennæ longer than the fourth, and such a strong "family resemblance" that I have thought it best to leave the question of farther subdivision until it seems to be more necessary. The larvæ of these dissimilar species require to be studied before their exact relations can be settled.

The genus *Tenthredo* seems to have but few representatives in this country. I have seen as yet but two or three species which belong to it or its several subsections. These I propose to describe at some future time.

## FAM. TENTHREDINIDÆ.

## GENUS ALLANTUS, PANZER.

Div. A. (Stephens). Antennæ short, somewhat clavate at the tip. None as yet found in the United States.

B. Antennæ not thickened at the apex.

a. Antennæ white at the tip.

Sp. 1. *A. terminalis*.

DECEMBER, 1860.



*Tenthredo terminalis.* Say. Long's Second Exp. II.  
318. ♀ ♂.

*A. melisoma.* Harris's Catalogue.

Inhabits U. S. (Say). Found in Connecticut, and Massachusetts (Harris's Collection).

The specimens in the Harris Collection called *A. melisoma* differ but little from the above.

Sp. 2. *A. mellosus.* Nov. spec. Antennæ white at tip; vertex and thorax black; abdomen testaceous yellow. (♀ Long. corp. 0.45 in. Ex. alar. 0.80 in. ♀ Long. 0.37 in. Ex. alar. 0.67 in.)

♀ Testaceous; antennæ black; four apical joints white; head pale yellow, sometimes testaceous; a lobate black spot on vertex, from occiput to clypeus, touching the eyes at summit; a narrow, pale line within it from two of the ocelli to antennæ, and connected between them; clypeus deeply emarginate; labrum rounded and fringed with pale hair; mandibles black at tip. Thorax black; edge of collar, wing-scale, a spot below each wing on pleura, a V on prothorax, scutellum, two dots behind, and ridge on metathorax, yellow; a broad band on pleura, the abdomen, and legs, testaceous yellow; a narrow line at base of second segment of abdomen and in middle of basal membrane overlapping first segment, black; coxæ and base of femora white; base of posterior coxæ black; wings hyaline; nervures fuscous; basal half of stigma white.

♂ The male has the two basal joints of antennæ white above; apical half of fifth joint white; pleura almost entirely white; abdomen and legs paler color than in female.

Inhabits Connecticut, and Pennsylvania (Dr. Clemens).

Eight specimens examined. This male is described by Say as the male of *A. terminalis*.

Sp. 3. *A. apicalis.* Say. Bost. Jour. I. 216. ♀.

Inhabits Indiana.

I have not seen this species.

Sp. 4. *A. abdominalis*. Nov. spec. Color black; antennæ at tip and the scutellum white; abdomen testaceous. (♀ Long. 0.37 in. Ex. alar. 0.75 in. ♂ Long. 0.30 in. to 0.35 in. Ex. alar. 0.65 in.)

♀ ♂ Head and thorax black; the four apical joints of antennæ white; clypeus, labrum, and trophi honey-yellow; mandibles black at tip; clypeus retracted and deeply emarginate, posterior edge black; labrum wider than long, somewhat angulate, and fringed with yellow hair; a blunt red spine between the antennæ; scutellum, two dots behind, and (commonly) the ridge of metathorax, white; abdomen and legs testaceous; first segment of abdomen black at base and edges; basal half of coxæ, the four anterior femora, apex of posterior femora, and all the feet, black; apex of coxæ, the trochanters, and base of femora, white. Wings faintly clouded; nervures black; basal half of stigma white; wing-scale piceous.

Hab. Farmington, Conn.

Eleven specimens examined. The apical segments of the abdomen are sometimes black in the males. This is closely allied to *A. apicalis* of Say.

Sp. 5. *A. trisyllabus*. Say. H. Cat. Undescribed. Black; a white band on antennæ near the tip; edge of collar, V spot, and scutellum, white. (Long. about 0.40 in. Ex. alar. 0.80 in.)

♀ Head, thorax, and abdomen, black; five apical joints of antennæ, base of fifth, and apex of ninth, black; clypeus, labrum, spot at base of mandibles, and palpi, white; clypeus produced, emarginate, and sprinkled with piceous dots; labrum with similar dots, rounded, sometimes almost truncate, and covered with scattered hair; edge of collar, V spot, scutellum, two dots behind, a line at apex and another at base of metathorax, and a narrow, short line at apex of four basal segments of abdomen, white; legs

black ; a line upon the four anterior legs beneath, the base of posterior femora, and a line more or less produced beneath, a large spot on posterior coxæ, the trochanters, and tips of all the coxæ, and base of femora, white. In some cases the joints of posterior tarsi are white. Wings slightly clouded ; nervures dark ; stigma and costa at tip lighter ; wing-scale black ; apex pale.

Hab. Connecticut, and Massachusetts (Mr. Scudder and H. Coll).

Thirteen specimens examined. In some of them the V spot and all marks back of the scutellum are indistinct or wanting. In one instance the ventral segments are tipped with white.

Sp. 6. *A. niger*. Nov. spec. Body black, antennæ semi-annulate, with white near the tip. (♀ Long. 0.37 in. Ex. alar. 0.75 in.)

♀ Black ; the apical half of the fifth, sixth, seventh, eighth, and base of ninth joints of antennæ white on upper side ; clypeus produced, emarginate ; disk of labrum and a spot on base of mandibles white ; front of clypeus and the labrum covered with whitish hairs ; head and thorax punctured, most coarsely on the occiput ; body immaculate ; the apical segments of abdomen and the venter glabrous, with fine ashy hair ; legs black, a white line on lower side of femora, tibiæ, and tarsi of four anterior legs, and a large white spot on posterior coxæ ; wings hyaline ; nervures dark piceous ; costa testaceous at tip.

Hab. Connecticut, and Pennsylvania (Dr. Clemens).

Five females examined.

Sp. 7. *A. grandis*. Nov. spec. Body blue-black ; the tip of antennæ, edge of collar, scutellum, and edge of basal membrane, yellow. (Long. 0.50 in. Ex. alar. 1.17 in.)

♀ Antennæ long and stout ; the four apical joints and base of first joint yellow, punctured, and covered with scattered ashy hairs ; clypeus produced and arcuate ; la-

brum rounded; disk of clypeus in part and of labrum wholly yellow; base of mandibles yellow; palpi piceous, apical joints pale; occiput and prothorax punctured, and thinly covered with short ashy hair; body blue-black; the edge of collar, scutellum, two dots behind, apical and basal edge of basal membrane, two spots near base of anterior coxæ on the pleura, and one near posterior coxæ, yellow; abdomen stout and dilated; a white line beneath anterior pair of legs, from middle of femora to feet; apical joints of tarsi and the feet piceous; femora of two posterior pair shining with close, fine hair; wings clouded, semi-transparent; nervures and stigma black; costa lighter at tip.

Hab. Farmington, Conn.

Two specimens examined.

b. Antennæ white at tip and base.

Sp. 8. *A. varius*. Nov. spec. Black; antennæ at base and tip yellow; V spot and scutellum white; abdomen dark rufous. (Long. 0.37 in. Ex. alar. 0.75 in.)

♀ Black; basal and four apical joints of antennæ reddish yellow; clypeus emarginate, labrum truncate, both pale yellow; a narrow pale mark back of the cheeks, and a deeply lunate, slender white line on occiput; mandibles rufous at tip; edge of collar, V spot, scutellum, two dots behind, and ridge of metathorax, white; abdomen dark red; basal segment black; legs rufous; tarsi, except the base of basal joint, the basal half of femora, and a large spot on posterior coxæ, white; coxæ, apex of posterior tibiæ, and feet, black; wings hyaline; nervures black; half of stigma, costa, and wing-scale, piceous.

Hab. Farmington, Conn.

Two specimens examined.

c. Antennæ white or yellow at base.

Sp. 9. *A. basilaris*.

*A. coronatus*. ♂ H. Cat.



*Tenthredo basilaris.* Say. Long's Sec. Ex. II. 316.

♀ ♂.

Hab. N. W. Territory (Say), Massachusetts (H. Coll.), Connecticut, New York.

Sp. 10. *A. dubius.* Harris. H. Cat. Black; antennæ piceous, basal joint yellow; abdomen with yellow bands. (Long. 0.50 in. Ex. alar. 0.95 in.)

♀ Body black; antennæ short and stout, piceous, basal joint pale; head wide, indistinctly piceous about the orbits; clypeus produced, angulate; labrum rounded; clypeus, labrum, base of mandibles, and palpi, yellow; wing-scale piceous; scutellum, two dots behind, edge and sides of basal membrane, a spot on pleura near posterior coxæ, the fifth, seventh, and two apical segments of abdomen above, yellow; legs piceous yellow, darkest (in one case black) on femora above and base of tibiæ; coxæ black, yellow at tip; trochanters yellow; pleura and body beneath black; wings clouded; nervures and apex of stigma black; basal half of stigma and costa piceous yellow.

Hab. Massachusetts (H. Coll.).

Two specimens examined. This is probably a variety of *A. basilaris*. The color of antennæ is different, the collar and pleura black, &c.

Sp. 11. *A. bicinctus.* Nov. spec. Black; basal joint of antennæ yellow; basal membrane yellow; and a rufous band in middle of abdomen. (♀ Long. 0.40 in. Ex. alar. 0.80 in. ♂ Long. 0.35 in. Ex. alar. 0.70 in.)

♀ Black; antennæ moderate, flattened in middle, basal joint yellow; a dot between antennæ, clypeus, labrum, and base of mandibles, yellow; the wing-scale, upper edge of collar and a wide mark on basal edge, narrowing to anterior legs, a spot on pleura and line from base of inferior wings, a V spot, the scutellum, post-scutellum, two dots behind, and ridge of metathorax, yellow; a deep rufous band on fourth, fifth, and sixth segments of abdomen;

basal membrane yellow, forming a band over first segment of abdomen; legs yellow; base of posterior coxæ, apex of femora, and tibiæ, black; feet in some cases black; wings faintly clouded; nervures piceous; stigma and costa at tip lighter.

♂ Resembles female, but the rufous band is wanting.

Hab. Connecticut, Massachusetts (Mr. Scudder), New York, Pennsylvania (Dr. Clemens), Maryland (Mr. Uhler), Florida.

Twenty specimens examined. This is allied to *A. bifasciatus* of Say. But the marks on that are white; the V spot and the marks on the pleura are not mentioned, nor the yellow basal joint of antennæ, and he places the rufous band on the fourth segment of the abdomen only.

Sp. 12. *A. intermedius*. Nov. spec. Black; basal joint of antennæ yellow; spot on pleura before anterior coxæ, scutellum, and basal membrane, yellow; and a rufous band on fourth segment of abdomen. (Long. 0.30 in. to 0.35 in. Ex. alar. 0.60 in. to 0.70 in.)

♀ Body black; antennæ about two thirds the length of those of *A. bicinctus*, and more slender; basal joint of antennæ beneath, disk of clypeus, basal half of labrum, a spot at base of mandibles, and the palpi, pale yellow; clypeus dotted with red, deeply emarginate; head, prothorax, and pleura, roughly punctured, and shining with fine, close hair; wing-scale, edge of collar, a small round dot on pleura, before the anterior coxæ, the scutellum, two dots behind, and basal membrane, yellow; fourth segment of abdomen dark rufous; legs yellow; the apical half of posterior femora, tips of tibiæ, and feet, black; wings faintly smoky; base of stigma pale.

♂ Resembles female, except that the antennæ are much stouter, the two basal joints yellow; clypeus and labrum yellow; rufous band on abdomen wanting, and all the coxæ black at base.

Hab. Connecticut and Massachusetts.

Two specimens examined. They strongly resemble *A. bifasciatus*, and also *A. cestus*, of Say.

Sp. 13. *A. cestus*. Say. Bost. Jour. I. 217. ♂ ♀.

Hab. United States (Say).

I have received one female from Kansas, through Mr. Uhler.

Sp. 14. *A. goniphorus*. Say. Bost. Jour. I. 216. ♂ ♀.

Hab. Indiana (Say), Connecticut, Pennsylvania (Dr. Clemens).

Sp. 15. *A. epicera*. Say. Bost. Jour. I. 216. ♂  
"Black; abdomen, base of the antennæ, and feet, honey yellow."

♀ Say describes only the male. The female differs in having the base of the coxæ black, and the trochanters and base of femora white.

Hab. Indiana (Say), and Connecticut.

Two females examined.

d. Antennæ black or of a dark hue.

x. Abdomen wholly or mostly rufous.

Sp. 16. *A. pallipes*. Say. West. Quarterly Rep., vol. ii. 1, 72, 1823.

"Black; thorax rufous before; feet white.

"Inhabits Missouri.

"Body black; labrum and palpi white; thorax with a rufous triangle before, a rufous spot on each side of the disk, another beneath the origin of the wing, and the tip of the scutel rufous; a whitish spot before the wings; wings a little dusky; carpus whitish; feet white; posterior thighs blackish in the middle; tergum, with the lateral basal margin of the segments, rufous; venter rufo-testaceous; each side dusky in the middle.

"Length seven twentieths of an inch."

The specimens taken by me differ from the above description as follows. The clypeus is yellow; the scutellum

rufous; the legs rufous; coxæ and base of femora white; tips of posterior femora and tibiæ, and, in some cases, of tarsi also, black. The "black mark in middle of posterior thighs" is wanting. (Long. 0.30 in. Ex. alar. 0.57 in. ♂ Long. 0.25 in. Ex. alar. 0.50 in.) ♂ Undescribed. The abdomen is black, with the third, fourth, and fifth segments rufous, (in one specimen the first and second segments are also rufous,) and all but the two apical segments rufous beneath; prothorax partly black.

I have seven specimens, taken in Farmington, Conn.

Sp. 17. *A. pinguis*. Nov. spec. Black; scutellum and mouth white; abdomen rufous. (Long. 0.30 in. Ex. alar. 0.60 in.)

♀ Head and thorax black; body robust; antennæ rather long and stout; joints diminishing equally in length; labrum, spot on mandibles, and palpi, dull white; mandibles piceous; clypeus scalloped in the centre; labrum fringed with pale hair; body covered with short ashy hair; head finely punctured, pleura more coarsely; wing-scale, scutellum, two dots behind, and ridge of metathorax, white; abdomen short, rufous, basal membrane black; legs whitish; coxæ black, except at apex; four anterior femora rufous above, toward apex almost black; posterior femora and tibiæ rufous, black at tips; spines rufous; wings faintly clouded; nervures piceous; base of stigma pale; second submarginal cellule almost square.

Hab. Westfield, Mass., and Farmington, Conn.

Var. ♀ Antennæ waxen yellow; base of second joint black above; edge of clypeus, the labrum, and mandibles, reddish yellow; wing-scales and nervures pale yellow.

Two specimens examined.

Sp. 18. *A. trosulus*. Say. H. Cat. Undescribed. Black; edge of collar, scutellum, and a line on pleura, pale yellow; abdomen dark rufous. (Long. 0.30 in. Ex. alar. 0.60 in.)



♀ Head and thorax black; antennæ long and thickened in the middle; joints diminishing equally in length; clypeus moderately emarginate; clypeus, labrum, base of mandibles, and the palpi, yellow; mandibles black at tip; wing-scale, edge of collar, scutellum, two dots behind, and a longitudinal line on pleura near base of intermediate legs, bright yellow; abdomen dark rufous, two basal segments black; legs yellow; a black line from middle of anterior tibiæ above to feet; half of posterior coxæ, the apical two thirds of femora, apex and base of tibiæ, basal half of first joint of tarsi, and all the feet, black; wings faintly smoky; nervures piceous; basal half of stigma pale; second submarginal cellule lengthened.

Hab. Connecticut and Massachusetts (H. Coll.).

Three specimens examined. One from Massachusetts, in the Harris Collection, is larger than the others, and the abdomen is wholly rufous.

Sp. 19. *A. rufescens*. Nov. spec. Antennæ, orbits, abdomen, and legs, dark rufous; vertex and thorax black; face, collar, and scutel, yellow. (Long. 0.40 in. Ex. alar. 0.80 in.)

♀ Color dull; head wide, and slightly roughened at apex; antennæ dark rufous, rather stout, two basal joints red; vertex black from back of head to clypeus; upper half of orbits rufous; a spot between and beneath antennæ, lower half of orbits and of face, base of mandibles, and palpi, yellow; clypeus produced, moderately emarginate; thorax black; edge of collar, scutellum, two dots behind ridge of metathorax and below, and a spot on pleura at base of coxæ, yellow; middle of pleura indistinctly rufous; abdomen and legs dark rufous; anterior coxæ at base, posterior coxæ, trochanters, femora, tips of tibiæ above, and tips of intermediate femora, black; tarsi pale reddish yellow; wings smoky in middle; stigma, costa, and wing-scale piceous.

Hab. Maine (H. Coll.).

One specimen examined.

Sp. 20. *A. tacitus*. Say. H. Cat. Undescribed. Black; abdomen rufous; wings violaceous. (♂ Long. 0.30 in. Ex. alar. 0.60 in. ♀ Long. 0.34 in. Ex. alar. 0.68 in.)

♂ Head and thorax black, head coarsely punctured, thorax smooth and shining; antennæ moderate, third joint but little longer than fourth; clypeus not deeply emarginate; labrum retracted, truncate; face immaculate; two white dots behind scutellum; abdomen bright red; basal membrane black; legs black; tips of anterior femora and base of tibiæ piceous; wings opaque, shining, violaceous; recurrent nervure received near the base of second submarginal cellule.

♀ A faint rufous tinge on the inner orbits, near the antennæ; labrum angulate, hairy; basal joints of palpi rufous above, remainder dark piceous; wing-scale piceous; abdomen paler than male; anterior tibiæ and tarsi piceous.

Hab. Farmington, Conn., and Massachusetts (H. Coll.).

Three specimens examined.

Sp. 21. *A. tardus*. Say. H. Cat. Undescribed. Black; abdomen rufous, and wings violet. (Long. 0.45 in. to 0.50 in. Ex. alar. 1.00 in. to 1.10 in.)

♀ Head and body black; antennæ moderate, somewhat flattened; clypeus not deeply emarginate; labrum produced and rounded, fringed with dark hair; head and thorax closely punctured, immaculate; abdomen rufous, flattened; basal membrane black; apical segment black, with a few black hairs; legs black; anterior pair of tibiæ and tarsi piceous; a white line on upper edge of posterior coxæ; wings violaceous, semitransparent.

♂ Anterior legs beneath and tarsi above piceous; the white line on posterior coxæ wanting.

Hab. Connecticut and Massachusetts (H. Coll.).

Five specimens examined.

Sp. 22. *A. tricolor*. Harris. MSS. Undescribed. Black; a yellow spot near posterior coxæ; apex of abdomen rufous. (Long. 0.48 in. Ex. alar. 0.95 in.)

♀ Black; antennæ long and slender, the two basal joints rufous within; clypeus moderately emarginate, and, with the labrum and mandibles, yellow; the two dots behind scutellum, spot on side of basal membrane, and a round dot near base of posterior coxæ, yellow; the first four segments of abdomen black, remainder rufous above and beneath; legs rufous; the coxæ, base of anterior femora, four posterior femora, posterior tibiæ, and first joint of tarsi, black, the two latter with a rufous tinge; wings hyaline; basal half of stigma pale.

Hab. Maine (H. Coll.).

One specimen examined.

Sp. 23. *A. signatus*. Nov. spec. Black; edge of collar, pleural spots, and coxæ, yellow; abdomen rufous, with black spots. (Long. 0.44 in. Ex. alar. 0.88 in.)

♀ Black; antennæ moderate, faintly rufous beneath toward tip, third joint long; clypeus produced, moderately emarginate; labrum and mandibles fringed with pale hair; clypeus, labrum, mandibles, palpi, and a spot on cheeks below the eyes, yellow; wing-scale, edge of collar, two dots behind scutellum, edges of basal membrane, a spot above posterior coxæ, and a spot and perpendicular line above intermediate coxæ, yellow; abdomen rufous above and beneath, with the two basal segments and disk of third above black; legs rufous yellow beneath, black above; posterior tibiæ, except at base, and the tarsi, black; apical joints reddish; coxæ yellow; wings hyaline; stigma pale at base.

Hab. Maine (H. Coll.).

Two specimens examined.

Sp. 24. *A. mellinus*. Harris. MSS. Undescribed. Color entirely pale honey yellow; long and slender. (♀ Long. 0.47 in. Ex. alar. 0.90 in. ♂ Long. 0.44 in. Ex. alar. 0.87 in.)

♀ Color pale honey yellow; antennæ long and slender, third joint long; lower half of face and of orbits yellow; mandibles at tip and ocelli black; clypeus produced, moderately emarginate; labrum and mandibles fringed with white hair; body long and slender; anterior coxæ and femora, and a spot at base of posterior coxæ, yellow; wings hyaline; nervures black; stigma and costa pale.

♂ The male has a black spot on vertex about the ocelli; wing-scale, collar, a distinct V on the prothorax, scutellum, pleura, pectus, and coxæ, pale yellow; a black line on posterior coxæ and half of femora above.

Hab. Maine (H. Coll.).

Two specimens examined.

xx. Abdomen with yellow or rufous bands.

Sp. 25. *A. rufocinctus*. Nov. spec. Black; first five segments of abdomen rufous. (Long. 0.30 in. to 0.35 in. Ex. alar. 0.62 in. to 0.70 in.)

♀ ♂ Black; antennæ short, the third joint but little longer than the fourth; clypeus almost inclosing the labrum, which is obtusely rounded, and fringed with pale hair; face immaculate; labrum in some cases dark piceous; mandibles and palpi piceous; wing-scale piceous; two dots behind scutellum white; first five segments of abdomen rufous, the first concealed by the black basal membrane; body smooth, shining, and in many parts covered with a close, shining pile of hair; legs rufous; coxæ, tips of posterior tibiæ, and the tarsi, black; the four posterior coxæ tipped with white beneath in females; wings smoky yellow, transparent; nervures black; basal half of stigma pale.

Hab. Farmington, Conn., and New Hampshire (H. Coll.).



Sixteen specimens examined, June, July, and August.

Sp. 26. *A. piceocinctus*. Nov. spec. Black; antennæ piceous beneath; a piceous band on abdomen. (Long. 0.52 in. Ex. alar. 0.85 in.)

♀ Dull black; antennæ long, second joint but little longer than third, color black, dark piceous beneath, the first and second joints piceous only at base; clypeus and labrum, mandibles and trophi, piceous, the former sprinkled with black; clypeus slightly emarginate; labrum retracted, rounded, and fringed with hair; mandibles black at tip; scutellum and two dots behind white; head and thorax finely punctured; the third, fourth, fifth, and sixth segments of abdomen piceous; a deep sinus on mesothorax from scutellum to anterior wings; legs piceous; all the coxæ and the four posterior femora black; posterior tibiæ and tarsi dark above; wings slightly smoky; nervures black; basal half of stigma white.

Hab. Brooklyn, N. Y., from Mr. Akhurst.

One specimen examined. It resembles *Tenthredo ignobilis* of England in form, but the wings are shorter in proportion to the length of body.

Sp. 27. *A. dejectus*. Nov. spec. Black; a piceous band at base of abdomen. (Long. 0.43 in. Ex. alar. 0.80 in.)

♂ Dull black; antennæ moderate, rather stout, third joint long; head and thorax coarsely punctured; clypeus deeply emarginate; labrum small; face black; labrum at tip and palpi piceous, the latter paler in middle; thorax dull black, immaculate; the three basal segments of abdomen dark piceous, most distinct at sides; legs black; the four anterior tibiæ beneath and the tarsi dark piceous; tarsi tipped with black above; wings faintly clouded; nervures and stigma black; second submarginal cellule moderately long, and receiving the recurrent nervure nearer the third cellule than usual.

Hab. Brooklyn, N. Y. (Mr. Akhurst).

One specimen examined. The abdomen and posterior legs are much shorter than in the preceding insect.

Sp. 28. *A. verticalis*.

*Tenthredo verticalis*. Say. Long's. Sec. Ex. II. 317. ♀  
"Head pale yellow; vertex and antennæ black; tergum yellowish, spotted with black, tip black. Length of the body three twentieths of an inch."

♂ The male is not described. It resembles the female, except that the cheeks are entirely yellow; the pleura, pectus, and venter, pale yellow; tergum testaceous yellow, with two black spots on each of the two basal segments, and the terminal segments sometimes dark or black; posterior tibiæ entirely testaceous; a V on the prothorax sometimes takes the place of the four lines mentioned by Say.

Hab. Northwest Territory (Say), Massachusetts (H. Coll.), Connecticut and Pennsylvania (Dr. Clemens).

Twelve specimens examined. The size indicated by Say is evidently an error, for all those that I have seen are from nine to nine and a half twentieths of an inch in length.

Sp. 29. *A. dissimilis*. Nov. spec. Black, with the face and six lines on thorax yellow, and terminal half of abdomen rufous. (Long. 0.45 in. Ex. alar. 0.90 in.)

♀ Head and thorax black; antennæ very long, a little flattened in middle; clypeus truncate, a deep scallop in middle; labrum produced, rounded; a line about the orbits, interrupted opposite the upper ocelli and again opposite the antennæ, two dots back of ocelli, the face about and beneath the antennæ, base of mandibles, and palpi, straw yellow; wing-scale and edge of collar, four lines in front of thorax, as in *A. verticalis*, and one on each side of scutellum, the tip of scutellum, and two pairs of dots behind, yellow; sides of basal membrane and the four

basal segments of abdomen beneath and on sides yellow, above black; remaining segments rufous; legs yellowish, rufous in part; the anterior femora above, the four posterior femora, and all the coxæ, black; a small white spot near base of posterior coxæ; wings faintly clouded toward tip; nervures black; stigma piceous; base and costa white.

Hab. Northern Illinois (Mr. Kennicott).

One specimen examined.

Sp. 30. *A. bifasciatus*. Say. West. Quarterly Rep., vol. ii. 1, 72, 1823. ♀ "Black; tergum with a white band at base and a rufous one in the middle.

"Inhabits Arkansas.

"Body black; nasus white; labrum and palpi dull whitish; thorax with a yellowish line before each wing; scutellum yellowish; wings dusky; nervures brown; feet white; tips of the posterior thighs and their tibiæ black; tergum with a white band at base and a rufous one on the middle. Length seven twentieths of an inch (♀)."

In Long's Second Exp. vol. ii. p. 317, it is stated that the rufous band is on the fourth segment.

This species is allied to *A. bicinctus* (No. 11), and still more closely to *A. intermedius* (No. 12). I find in the Harris Collection a species called *A. medius*, (Say,) which is perhaps a variety of the above. The basal joints of antennæ are black; head wide, punctured; thorax coarsely punctured; clypeus moderately emarginate; labrum produced, truncate. It differs in having the sides of clypeus and labrum black; the color of the legs pale yellow; coxæ black, except at tips; and the tips of four anterior tarsi, and all the toes, rufous black. The wings are faintly clouded, nervures and stigma dark piceous, and basal half of stigma pale. The fourth segment of abdomen is indistinctly rufous.

Hab. New Hampshire.

Until more specimens can be examined, it will be diffi-



cult to determine whether this is a variety or separate species.

xxx. Abdomen black.

Sp. 31. *A. angulifer*. Nov. spec. Black; a lobate black spot upon the head; a V spot on prothorax, an angulate mark on the pleura, and body beneath, white. (Long. 0.47 in. Ex. alar. 0.90 in.)

Black; antennæ long and slender; head wide, pale yellow; the back and all of summit, and a lobate spot on vertex, black; the lower three fourths of orbits yellow; clypeus produced, moderately emarginate; labrum and mandibles fringed with pale hair; wing-scale, edges of collar, a V on prothorax, two dots behind scutellum, two slender, radiating lines above and below these dots, a broad, angulate mark on pleura, a spot near base of posterior coxæ, and the whole body beneath, pale yellow; some indistinct, pale marks at junction of first four segments of tergum; legs pale yellow; on the two anterior pair a black line above, from middle of femora to feet, interrupted near base of tibiæ; posterior coxæ black above at base; apical half of femora, apex of tibiæ, and the tarsi above, black; apical joints pale; wings hyaline; nervures and stigma black, and base of stigma and costa pale; third submarginal cellule rather long.

Var. a. Sides of first four segments of abdomen pale yellow, and the remaining segments rufous; pleura almost entirely yellow, with an irregular angulate spot beneath wings; coxæ yellow; tarsi rufous; posterior legs black on the upper side only; wings somewhat clouded.

♂ The male is black, long, and slender, with five large, pale, diamond-shaped spots on tergum, at the joints of five basal segments of tergum; pleura with a black spot as in Variety a. Color of body and legs beneath pale greenish yellow; posterior tibiæ and tarsi black, with a white spot on tibiæ above; apical joints of all the tarsi green; wings hyaline.



Hab. New Hampshire, Maine (H. Coll.), and Albany, N. Y.

Four specimens examined. This resembles *A. ventralis* of Say.

Sp. 32. *A. lobatus*. Nov. spec. Body black; head pale yellow, with a lobate black spot upon the vertex. (Long. 0.48 to 0.50 in. Ex. alar. 0.90 in.)

♀ Black; antennæ long, enlarged in middle; head yellow, black behind and above; a lobate black spot on vertex; orbits pale straw yellow, only interrupted opposite the ocelli; a spot on basal joint of antennæ within, and the base of mandibles, yellow; clypeus produced and widened; edges of collar, wing-scale, V on prothorax, two dots behind, two radiating lines above and two below these dots, the sides of basal membrane, and a spot near posterior coxæ, pale yellow; on the venter, the overlapping plates irregularly whitish; a deep sinus behind mesothorax, at base of superior wings; body finely punctured, and in some parts shining with close, hairy pile; legs yellow; coxæ black, tipped with yellow; a narrow black line on the four anterior femora and tibiæ above; posterior femora black, except at base; tibiæ at tip and tarsi above black; apical joint whitish; wings hyaline; nervures black; base of stigma white.

Var. a. Two dots back of ocelli; a spot on pleura below wing-scale, four lines in place of V spot, apex of scutellum, six dots and two lines behind, yellow.

Hab. Farmington, Conn.

Three specimens examined.

Sp. 33. *A. ventralis*. Say. West. Quar. Rep. vol. ii. p. 72. "Black; feet before and abdomen beneath white.

"Inhabits Arkansas.

"Body black; nasus, labrum, mouth, abbreviated line above the eye and large spot beneath it, white; thorax

with a line before the wing, small spot each side of scutellum, white; wings a little dusky; feet white before; pectus with a white line on each side, and somewhat testaceous central spot; tergum immaculate; venter white.

"Length nine twentieths of an inch." Sex not mentioned.

I have not seen this species.

Sp. 34. *A. leucostoma*. Kirby. Faun. Bor. Am. 256, 354.

"Length of the body six lines (0.50 in.).

"Body narrow, black, glossy, without hairs. Head scarcely so wide as the trunk, wedge-shaped; palpi, suborbicular upper lip, emarginate nose, and base of the mandibles, white; apex of the latter rufous; antennæ a little shorter than the trunk, nine-jointed, with the third joint longest; neck constricted; tegulæ testaceous; wings subhyaline, with piceous nervures; legs yellow, with the apex of the tibiæ and whole of the tarsi of the posterior legs black; abdomen linear, acute at the anus.

"This species comes near *A. ater*" (Europe). I have not yet seen it.

Sp. 35. *A. flavomarginis*. Nov. spec. Black; face and edge of collar yellow. (Long. 0.50 in. Ex. alar. 1.00 in.)

♀ Body black, slender, shining; antennæ rather short; clypeus produced, emarginate; clypeus, labrum, a spot on cheeks, base of mandibles, and palpi, yellow; head a little wider than thorax; wing-scale and edge of collar yellow; two dots behind scutellum, the sides of basal membrane, and a spot near posterior coxæ, yellow; legs black, anterior pair and the intermediate tibiæ and tarsi waxen yellow beneath; a small yellow dot near the tip of anterior femora above; toes waxen yellow; femora covered with a fine pile beneath; wings clouded toward apex; nervures brown; stigma pale at base.

Hab. Farmington, Conn.

One specimen examined.

Sp. 36. *A. atrovioaceus*. Harris. H. Cat. Body black; wings violaceous. (Long. 0.50 in. Ex. alar. 1.10 in.)

♂ Body black, in some lights having a faint bluish tinge; antennæ long, having a rufous tinge beneath; body shining, and coarsely punctured on head and thorax, more finely on mesothorax; face black; clypeus angulate; labrum almost conical; mandibles large, punctured, and, with the labrum, fringed with hair; abdomen much flattened; legs punctured, posterior pair long; a white line on posterior coxæ above; anterior tibiæ and tarsi, and apical joints of all the tarsi, piceous; wings violaceous, almost opaque, irregularly marked with whitish lines along the apical nervures.

♂ The antennæ of the male are piceous, brightest toward the tip.

Hab. Connecticut, Massachusetts, Maine (H. Coll.).

Five specimens examined, one of which, without the bluish tint, is called *A. carbonarius* in the MSS. Catalogue of Dr. Harris. This resembles *A. tardus* in form.

Sp. 37. *A. rufipes*.

*Tenthredo rufipes*. Say. Long's Sec. Ex. II. 318. ♀.

Hab. Northwest Territory (Say), Massachusetts (H. Coll. and Mr. Scudder).

Two specimens examined.

Sp. 38. *A. rufopectus*. Nov. spec. Body black; antennæ, pectus, and legs, rufous. (Long. 0.40 in. to 0.42 in. Ex. alar. 0.85 in. to 0.90 in.)

♀ Black; antennæ dark rufous, tips of joints above black (in some cases, the first and second joints are black above); clypeus angulate; labrum orbicular, and, with the mandibles, fringed with hair; labrum, base of mandibles, and palpi, yellow; body shining; wing-scale, edge of collar, two dots back of scutellum, and four radiating lines,

two above and two below these dots, yellow; a white spot near base of posterior coxæ; pectus and legs bright red; the four anterior tibiæ and tarsi, and the intermediate femora, tipped with black; posterior tarsi, basal half of tibiæ, and tips of femora, black; wings hyaline; basal edge of stigma and the costa pale.

♂ The male has a yellow spot on each side of the disk of clypeus; the second and third segments of abdomen are sometimes indistinctly rufous in part; abdomen above covered with a close, fine pile.

Hab. Farmington, Conn., and Pennsylvania (Dr. Clemens).

Ten specimens examined.

Sp. 39. *A. albomaculatus*. Nov. spec. Black; a white spot on coxæ; posterior tibiæ black. (Long. 0.35 in. to 0.37 in. Ex. alar. 0.65 in. to 0.70 in.)

♀ Body black; antennæ moderate, first joint covered with short, fine hair; head and thorax punctured, most coarsely back of the ocelli; clypeus widely emarginate, with sharp angles; labrum produced, truncate, and fringed with coarse, whitish hair; disk of clypeus and labrum, base of mandibles, basal joints of palpi, and two dots behind scutellum, yellow; a large spot on posterior coxæ above white; tip of same coxæ, trochanters, and basal tip of femora, a line on the four anterior coxæ, and the anterior pair of legs beneath, pale yellow; wings hyaline; nervures black; base of stigma pale.

♂ The male has the four apical joints of antennæ rufous beneath; clypeus immaculate, and not deeply emarginate; a white spot on wing-scale; all the coxæ and the four anterior legs pale yellow beneath; anterior tarsi with black tips.

Hab. Connecticut and Maine (H. Coll.).

Four specimens examined. One in the Harris Collection has the wings dusky at tip, and clypeus not deeply emarginate.



Sp. 40. *A. pannosus*. Say. Bost. Jour. I. 218. ♀ ♂  
 "Black; mouth white; feet varied with white. (♀ Long.  
 0.30 in. ♂ Long. 0.25 in.)

"Inhabits Indiana."

The dark wing-scale and white edge of collar; immaculate pleura; white coxæ, with a black spot above and below; anterior legs white below, and posterior legs with black femora and a band on tibiæ of female, and a white line on male; and base of ultimate joints of the tarsi white; are the exterior marks of this species, which I have not seen.

Sp. 41. *A. externus*. Say. West. Quar. Rep. II. 72. ♀  
 "Black; tibia white on the exterior side. Length nine twentieths (0.45) of an inch.

"Inhabits Missouri.

"♀ Body deep black; head, with a spot each side on the nasus, and base of the mandibles, white; wings fuliginous; nervures black; thighs at tip above, incisures of the coxæ, exterior side of the tibia, and tarsi, white; posterior feet robust.

This I have not seen. *A. flavicollis* seems somewhat like it. Its size of body and posterior legs are sufficient to distinguish it from the following species.

Sp. 42. *A. epinotus*. Say. Bost. Jour. I. 215. ♀ ♂ *A. sambucci*. H. Cat. "Black; tergum with a white band at base; feet varied with white.

"Length, ♂ three tenths, ♀ less than two fifths of an inch.

"Body black; mouth white; tongue piceous; thorax, with the posterior edge of the collar, wing-scale, posterior edge of the scutel, and two minute dots behind it, white; wings with brown nervures; stigma somewhat inflated; tergum with the posterior margin of the first segment white; feet white; coxæ with a dilated line before and behind; anterior and intermediate thighs and tibiæ with a

black line behind; tarsi dusky at tips of the joints; posterior thighs black in the middle; tibiæ at base and tip black; tarsi, first joint black, remaining joints black, white at base."

Var. a. ♂ ♀ The *A. sambucci* of Harris's Catalogue. This has the spot on scutellum wanting, and a short, white line on posterior tibiæ above.

Var. b. ♀ This has the scutellum black; coxæ black, with white tip and a white line on posterior tibiæ above, in one case long and in another short.

It may be remarked, that *A. cestus*, *A. intermedius*, *A. medius*, of Harris, and *A. epinotus* are closely allied, and will require the investigation of a larger number of specimens before their names can be definitely settled.

Sp. 43. *A. flavicoxæ*. Nov. spec. Black, with edge of collar, coxæ, and legs in part, yellow. (Long. 0.32 in. Ex. alar. 0.65 in.)

♀ Body black; antennæ moderate; vertex and thorax punctured; clypeus half inclosing labrum, which is obtusely rounded, and fringed with pale hair; clypeus, labrum, spot at base of mandibles, pale yellow; palpi yellow, dark at tip; wing-scale, edge of collar, and two dots behind scutellum, yellow; pleura immaculate; legs yellow; coxæ yellow, basal tips black; a band in middle of four anterior femora and a slender line on anterior tibiæ and tarsi above, apical half of posterior femora, apex and base of tibiæ, base of first joint of tarsi, and the nails, black. In some cases, all the tarsi are tipped with black. Wings faintly smoky; nervures black; base of stigma pale; costal nervures distinctly separated.

Hab. Farmington, Conn., and Maine (H. Coll.).

Sixteen specimens examined.

Sp. 44. *A. incertus*. Nov. spec. Black, with edge of collar and legs yellow; posterior femora at tip and the tibiæ black. (Long. 0.30 in. Ex. alar. 0.60 in.)

♂ Body black; antennæ moderate; clypeus and labrum, spot at base of mandibles, and palpi, whitish; clypeus deeply emarginate; labrum truncate; wing-scale, edge of collar, and two dots behind scutellum, yellow; legs yellow; coxæ at basal tips black; four anterior legs immaculate; apical half of posterior femora above, the tibiæ, and basal half of first joint of tarsi, black; wings slightly clouded; nervures black; and stigma pale at base.

Hab. Farmington, Conn.

One specimen examined. This may be the male of *A. flavicoxæ*.

Sp. 45. *A. flavolineatus*. Nov. spec. Black, with edge of collar, scutellum, a line on pleura, and legs in part, yellow. (♀ Long. 0.32 in. Ex. alar. 0.65 in. ♂ Long. 0.25 in. Ex. alar. 0.55 in.)

♀ Body black; antennæ moderate; head and thorax punctured, most densely about the ocelli; clypeus sparsely punctured, almost inclosing the labrum, which is truncate, and fringed with hair; clypeus and other parts of mouth pale yellow; mandibles at tip and apical joints of palpi at tip black; wing-scale, edge of collar, apex of scutellum, two dots behind, and a broad line on pleura before intermediate legs, pale yellow; tip of anal segment of abdomen sometimes white; legs yellow; coxæ yellow; on the anterior pair a slender black line above, from middle of femora to nails; the intermediate femora above toward apex, the tibiæ, and tarsi at tips are black; the apical half of posterior femora, the apex and base of tibiæ, and the tarsi are black. In some cases the posterior tarsi are only tipped with black. Wings hyaline, faintly smoky; nervures dark; stigma enlarged, pale at base.

♂ The male has the pleural mark and posterior coxæ pure white; the four anterior legs straw-color, with a very slender black line on the anterior tibiæ, and the tarsi tipped with black; the posterior tibiæ black, with a short white line in middle above.

Var. a. ♂ The first joint of antennæ white beneath; collar edged with white on three sides; pleural band wide; scutellum black.

Var. b. ♂ Antennæ stout; spot on scutellum very minute or wanting; posterior coxæ black at base, and posterior tibiæ entirely black.

Hab. Farmington, Conn.

Seventeen specimens examined.

Sp. 46. *A. obesus*. Say. H. Cat. Undescribed. Black; body stout; wings fasciate. (Long. about 0.35 in. Ex. alar. 0.74 in.)

♀ Shining black; thorax wide; abdomen short and stout; head narrower than thorax, coarsely punctured; vertex surrounded by an oval ridge, inclosing the anterior ocellus; antennæ moderate, third joint long; ocelli pale; face immaculate; palpi piceous at tip; clypeus moderately emarginate; thorax rough, immaculate; two pale dots behind scutellum; legs yellow; intermediate femora at tip above, posterior coxæ at base, apical half of femora and of tibiæ, and all the nails, black; wings hyaline; nervures dark brown; stigma inflated, black; a broad, brownish fascia upon superior pair, crossing the second and third submarginal cellules.

Hab. Massachusetts (H. Coll.).

One specimen examined, of which the upper half of abdomen is wanting.



ART. IV.—*Descriptions of New Species of Crinoidea from the Carboniferous Rocks of the Mississippi Valley.* By JAMES HALL.

[Read Dec. 19th, 1860.]

GENUS ACTINOCRINUS.

*Actinocrinus leucosia* (n. s.). Body depressed-turbinate, broadly truncate at base; dome moderately elevated, surmounted by a central proboscis. Basal plates projecting as a salient trilobed rim, slightly excavated for the attachment of the column. Radial series large, first radial plates more than once and a half as wide as high; second radial plates quadrangular, twice as wide as high; third radial plates broad, pentangular, supporting on each upper inclined side a double range of short, broad, supra-radial plates; the upper one of each series is a bifurcating plate, and supports on each side a double set of brachial plates, giving four arms to each ray, except in the anterior ray, where there are two arms, making the brachial formula  $\frac{2}{4\frac{1}{4}} = 18$ .

Interradial series consisting of from three to five plates each; the first large, eight or ten sided, supporting two in the second range, and two in the third range, where there are five in the series. First anal plate heptagonal, equal to the first radial plates in height, but much narrower; supporting three smaller plates in the second range, with several smaller plates above, the number and arrangement not determined. Surface of plates moderately and regularly convex, without ornament.

Arms strong, simple, composed of a double series of short, broad plates, very obtusely wedge-form at the interlocking edges. Dome composed of numerous small tuberculose plates; somewhat lobed by depressions corre-

sponding with the interradial and anal spaces. Column large, round, and composed of strong, equal joints, which are sharply angulated, enlarging below the junction with the body, and again diminishing where the joints become much longer below.

This species resembles, in general expression of the body, those of the type of *A. cornigerus*, (Iowa Geol. Rep. pl. 9, fig. 12,) but differs in the absence of spines on the dome, and in having a central proboscis instead of a central spine.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. Collection of C. A. White of Burlington.

*Actinocrinus clio* (n. s.). Body narrow, urn-form, slightly spreading at the arm bases; base slightly truncate; dome hemispherical. Basal plates short, thickened at the lower margins, produced, and forming a low rim around the base of the cup. First radial plates proportionally large, wider than high; second radial plates small, quadrangular; third radial plates larger than the second, pentagonal, obtusely wedge-form above, supporting on each upper inclined side a proportionally large supra-radial bifurcating plate; these support on each upper side short, small, brachial plates, two ranges of which are so placed as to contribute to the general form of the body. In the anterior ray the third radial plate supports a double range of brachial plates on each side, giving two arms to that ray, and four to each of the others.

Interradial series consisting of but one plate each, which is eight or nine sided. First anal plate heptagonal, little smaller than the first radial plates; supporting three plates in the second range, and two in the third range. Surface of plates, when well preserved, marked by fine radiating lines, which are formed by confluent granules; the first radials and first anal plate slightly protruding in the centre;

plates of the dome without nodes, numerous, small, and polygonal.

Arms slender, round at base, becoming gradually flattened and broader on the back above, at the widest part more than double their width at base, composed of a double series of very short plates; each of these bears on its lateral angles a short point or sub-spine, which becomes gradually longer towards the flattened portion of the arms. Column round, of medium size, composed near its junction with the body of strong plates.

This species resembles in general expression *A. turbinatus* and its variety *elegans*, (Geol. Rep. Iowa, pl. 11, figs. 1 and 5,) but differs in the arm formula, and in the flattening of the arms. The dome also of this is hemispherical, while in that species it is depressed-convex, with strong nodose plates.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White of Burlington.*

*Actinocrinus equibrachiatus* var. *alatus*. Body variable in form, sometimes broadly turbinate, the depth below the arms equal to half the transverse diameter, and sometimes so short as to appear scarcely more than a stellate disc; the dome above the arm bases is usually nearly equal in height to the body below the arm bases. In some specimens the interbrachial and anal spaces are constricted half the depth from the periphery to the centre, giving a deeply pentalobate form, while in others they are scarcely depressed.

This species has the same arm formula and general structure as *A. equibrachiatus*, McChesney, and the deep constrictions between the rays give it a stellate or pentalobate form, not noticed in typical specimens of the species. This variety differs from *A. sinuosus* (which it resembles in the sinuosities or constrictions between the rays) in

having nodose plates of body and dome, and in the important distinction of having four arms to each ray, instead of five in the postero-lateral rays, as in that species.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White of Burlington.*

*Actinocrinus opusculus* (n. s.). (*A. opusculus*. 1st Supp. to Geol. Rep. Iowa, Explan. of pl. 2, fig. 6.) Body broadly caliculate, height little more than half the width, the brachial plates spreading around the circumference of the cup in the form of a rim; base truncate, and largely excavated for the attachment of the column. Basal plates short, thickened at the outer margins, and indented at the suture lines. First radial plates wider than high, with long upper lateral sides. Second radial plates quadrangular and pentangular, wider than high. Third radials larger than the second, varying from pentagonal to hexagonal and heptagonal, very obtusely wedge-form above, and supporting on each upper sloping edge a large bifurcating supra-radial plate; these each support upon the outer edge a series of brachial plates, and upon the inner edge a supra-radial plate of the second order, which gives origin to two arms, making six arms to each ray, and thirty arms to the whole.

Interradial series consisting of four or five plates each, the first one seven or eight sided, supporting two in the second range, one six and the other seven sided, and one or two small plates in the third range. First anal plate hexagonal, about equal to the first radial, supporting two or three slightly smaller plates in the second range, with two to four irregularly placed above. The interradial and anal spaces are inclosed or arched over by the brachial plates. Surface of plates strongly convex, traversed by distinct ridges, which, passing from the centre of the plates, unite at the edges with those of the adjoining ones.



Arms proportionally strong, round at the base, and becoming somewhat flattened above; composed of a double series of interlocking plates, armed at their outer edges with short, spine-like nodes. Proboscis strong, composed of small plates. Column of medium size, composed of short, alternately thicker and thinner plates, ornamented on the margins.

This species is of the type of *A. multibrachiatus*; but differs from that and all other described species in the ornaments of the surface, the crowded horizontal brachial plates, and flattened arms. In this latter character it resembles *A. clio*, but differs materially in form of body and arm formula.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White of Burlington.*

*Actinocrinus corbulis* (n. s.). Body broadly caliculate; dome highly convex, sub-hemispherical, surmounted by a sub-central proboscis. Basal plates short, with strongly projecting lower margins, slightly indented at the suture lines. First radial plates short, twice as wide as high. Second radials very small. Third radial plates very small, obtusely wedge-form above, supporting on each upper edge a series of two supra-radial plates, the upper ones of which support on the upper inclined edges the brachial plates; two of these contribute to the form of the body or calyx. Brachial formula  $\frac{4}{4} = 20$ .

Interradial series consisting of from one to three plates each. First anal plate heptagonal, higher and narrower than the first radial plates, supporting three anal plates above in form of an arch. Surface of plates slightly convex, the interradials a little depressed. The brachial spaces are somewhat impressed, giving a slightly lobed appearance at the arm bases. Dome composed of nodose plates, the three above each ray large and distinctly tuber-

culose, while the intermediate ones are small and depressed.

This species resembles the *A. clavigerus*, (Supp. Iowa Rep. page 44,) but differs in its larger and more protruding base, and in the depression of the interrarial plates, causing the radial series to stand out in the form of ridges, while the *A. clavigerus* is symmetrically smooth below the arms.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collections of C. A. White and B. J. Hall of Burlington.*

*Actinocrinus clalia* (n. s.). Body broadly caliculate; dome highly convex, surmounted by a sub-central proboscis. Basal plates short, somewhat projecting laterally, salient at the outer margins, and deeply indented at the suture lines. First radial plates of medium size, little wider than long. Second radials small, quadrangular. Third radials small, pentagonal or heptagonal, obtusely wedge-form above, supporting on each side, in the anterior ray, a series of three brachial plates, giving origin to two arms. In the other rays they support on each side a series of two supra-radial plates, the upper one of which is wedge-form above, and supports on each sloping side a series of two brachial plates, giving origin to four arms from each, making the brachial formula  $\frac{2}{44} = 18$ .

Interrarial series consisting of three to four plates each; the first eight-sided, about two thirds as large as the first radial plates, supporting two smaller, somewhat elongate plates in the second range, with sometimes an intercalated plate above. First anal plate heptagonal, a little smaller than the first radial plates, supporting three in the second range and two in the third. Surface of the body plates sub-spinous or strongly tuberculose; those of the radial series are elevated in the centre, giving the appearance of a ridge passing along the ray. Dome com-

posed of medium sized polygonal plates, some of which are tuberculiform or sub-spiniform.

This species resembles *A. corbulis* in general appearance, but differs in the arm formula, in the less spreading calyx, and the longer tubercles.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White of Burlington.*

*Actinocrinus rusticus* (n. s.). Body broadly spreading to the arm bases, which project in the form of strong lobes; dome depressed-convex, surmounted by a sub-central proboscis. Basal plates very short. First radial plates proportionally large, wider than high, superior lateral sides long. Second radial plates hexagonal. Third radial plates smaller than the second, pentagonal, twice as wide as high, obtusely wedge-form above, supporting on each upper side a supra-radial bifurcating plate, which on the outer margin supports brachial plates, and on the inner margin supports a supra-radial plate of the second order, which gives origin to two arms, making three to each main division of the ray, and six to the ray, giving the arm formula  $\frac{6}{6}\frac{6}{6} = 30$ .

First interradial plate large, hexagonal, supporting two smaller hexagonal plates in the second range, with three or four plates in the third range, situated high up in the brachial spaces. First anal plate hexagonal, smaller than the first radials, sustaining two smaller hexagonal plates in the second range, with several smaller plates irregularly placed above. Surface of the body plates highly tuberculose, the tubercles of the basal plates generally much extended. Dome composed of small, polygonal, slightly convex plates.

This species resembles *A. verrucosus*, (Iowa Geol. Rep. pl. 11, fig. 7;) but differs in being much broader in proportion to its height, the dome less elevated, with plates never



becoming tubuculose, the proboscis proportionally more slender, and the smaller size of the fossil.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collections of C. A. White and B. J. Hall of Burlington.*

*Actinocrinus limabrachiatus* (n. s.). Body turbinate below the arms, narrowly truncate at base, somewhat excavated for the attachment of the column; arm bases slightly projecting; summit unknown. Basal plates short, angularly thickened at the lower margin. First radial plates of medium size, height and width nearly equal. Second radial plates quadrangular, upper and lower margins convex. Third radial plates heptagonal, much larger than the second, wedge-form above, supporting on each side a large, supra-radial, bifurcating plate; each of these supports on the outer margin a series of brachial plates, and on the inner margin a small supra-radial plate of the second order, each of which gives origin to two arms, making three arms to each division of the ray, or six to the ray.

First interradiat plate octagonal, supporting two smaller plates in the second range, two in the third, and one in the fourth range. Anal series consisting of about twelve plates: the first hexagonal, smaller than the first radial plates, supporting two in the second range nearly equal in size, one seven sided and the other eight sided; four smaller plates in the third range; with the remaining plates irregularly placed above. Surface of plates traversed by a single set of ridges, which passing from plate to plate meet at the centres and form sharp nodes.

Arms long, slender, simple, composed near their base of a single series of wedge-form plates, and above of a double series of short interlocking plates, each of which has a sharp elevated ridge near and parallel to its upper margin; the edge of this ridge is directed upwards, and has the ap-



pearance of the teeth of a file. The tentacula are long and slender, composed of numerous joints, each of which has, on its outer edge, a strong, sharp, curved spine, inclined obliquely outwards and upwards. Column composed near the body of alternately thicker and thinner joints, every fourth of which is larger, and projects beyond the others as a carinated ring.

In the specimen examined only the lateral rays are determinable; but the peculiar character of the arms is sufficient to distinguish this from every other described species.

This species most resembles *A. spinotentaculus*, but differs in the number of arms to the ray, the teeth-like ridges of the arm plates, and the single series of plates near the arm bases. The arms of several other specimens are known.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Actinocrinus reticulatus* (n. s.). Body broad, sub-turbinate, truncate at base, and deeply excavated for the attachment of the column. Basal plates short, thickened at the lower margins, and projecting downwards over the top of the column. First radial plates of medium size, little wider than high, the upper lateral sides very long. Second radial plates smaller, wider than high, hexagonal, except in one postero-lateral ray, where it is quadrangular. Third radial plates hexagonal or heptagonal, usually equal to the second radials, supporting on each upper inclined side a supra-radial plate; this is wedge-form above, and supports on each side a series of brachial plates, except in the anal portion of the postero-lateral rays, where there is an additional supra-radial plate of the second order on the inner margin of the first supra-radial plate, giving three arms to that portion of the ray; making the brachial formula

$$\frac{4}{5} = 22.$$

In the centre of the ray between the brachial plates there is an elongate interbrachial plate, sometimes reaching down so as to truncate the top of the third radial plate. First anal plate nearly equal to the first radials, hexagonal, supporting two smaller plates in the second range, five in the third range, with five or six small plates irregularly placed above. Surface of plates strongly convex, marked by a series of ridges passing from plate to plate, but becoming obsolete near the middle of each, giving an appearance as if the plates had been worn.

This species is most nearly related to *A. sexarmatus* (1st Supp. Iowa Geol. Rep. p. 21) in general form and surface markings; but differs in being much wider in proportion to the height, with plates more regularly convex, and a different arm formula.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Actinocrinus unispina* (n. s.). Body sub-turbinate, abruptly spreading from the third radial plates, and becoming somewhat pentalobate from the projection of the arm bases, truncate at base, and moderately excavated for the attachment of the column; dome depressed-convex, surmounted by a long, slender, sub-central spine. Basal plates short, thickened at the lower margins, forming a slightly projecting rim around the base of the cup. First radial plate of moderate size, wider than high. Second radial plates quadrangular, twice as wide as high. Third radial plates short, pentagonal, wedge-form above, supporting on each side, in the postero-lateral rays, a large, supra-radial, bifurcating plate, which supports on each side a brachial plate, giving four arms to each ray; while on the anterior and antero-lateral rays the brachial plates rest directly on the third radial plate, giving two arms to the rays; making the brachial formula  $\frac{2}{4}\frac{2}{4} = 14$ .

Interradial series consisting of three plates each; the

first plate eight-sided, supporting two narrow, elongate plates, which occupy the spaces between the arms of the adjacent rays. First anal plate seven-sided, nearly or quite as large as the first radial plates, supporting three in the second range, with smaller plates above (the arrangement of which is not determined); these extend up to the aperture of the somewhat protruding anal area. Surface of body plates smooth, with ridges in the direction of the rays, caused by the elevation of the centres of the plates of the radial series. Dome composed of numerous small, slightly convex, polygonal plates.

The peculiarity of this species consists in the anal opening, the central spine, the protruding arm bases, and the ridges traversing the radial series. It resembles the species of the type of *A. cornigerus*; but differs in the absence of lateral spines or tubercles over the centre of each ray, as well as by the presence of the ridges. It differs also from *A. leucosia* in the arm formula and in the ridges, but like that has no lateral spines. The anterior ray is slightly imperfect in the individual described, but the form and size of the lobe leave no doubt in regard to the number of arms.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Actinocrinus* (Megistocrinus) *Whitei* (n. s.). Body pocilliform, the height and greatest breadth nearly equal; dome flattened or depressed-convex. Basal plates of medium size, spreading almost horizontally from the top of the column. First radial plates moderately large, height and width sub-equal, superior lateral sides nearly equal to the lower. Second radial plates proportionally large, hexagonal. Third radial plates pentagonal, sometimes hexagonal, smaller than the second radials, wedge-form above, and supporting on each upper side a short hexagonal plate, upon which rest the first arm plates.



First interrarial plate hexagonal, as large as the second radials or larger, supporting two smaller heptagonal plates in the second range, with three in the third, and three or four in the fourth; and above these are still smaller plates, which unite with the plates of the dome. First anal plate heptagonal, as large as the first radial plates, supporting three smaller plates in the second range, with four in the third range, above which are ten to fifteen smaller, irregular plates.

Arms two from each ray, bifurcating soon after becoming free; the branches, strongly diverging and curving upwards, again bifurcate, and still strongly divergent. The arm plates are a single series of obtusely wedge-form plates near the base, becoming double from the fourth or fifth plate, after which they continue in double series. At each bifurcation the arms gradually diminish in size.

Surface smooth, with an incipient ridge passing along the middle of the radial series. Column round, of moderate strength, composed of very short plates.

This is a very distinct and well-marked form, though the bifurcations of the arms vary in different individuals.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collections of C. A. White and Dr. Thieme of Burlington.*

*Actinocrinus fiscellus* (n. s.). Body discoid, flattened or slightly concave, to the extent of the third radial plates, from which it rises abruptly with little increase in width to the arm bases; strongly pentagonal, the anal side much the largest. Basal plates small, extending little beyond the column. First radial plates proportionally large. Second radial plates quadrangular, wider than high. Third radial plates short and wide, pentangular, obtusely wedge-form above, supporting on each upper side, in the anterior and antero-lateral rays, a series of brachial plates, giving two arms to each; in the postero-lateral rays they



support, on the anal side, a supra-radial bifurcating plate, on each side of which rests a brachial plate; and on the other side a single brachial plate, giving three arms to each, making the brachial formula  $\frac{2}{3/3} = 12$ .

First interrarial plates comparatively large, ten-sided, supporting two elongate plates in the second range. First anal plate heptagonal, as large as the first radial plates, supporting three smaller plates in the second range; the two lateral ones eight-sided, a little smaller than the first interrarial plates; middle one smaller, five-sided. The third range of anal plates consists of three small ones, above which they are not determinable. Surface of plates of the radial series marked by angular nodes, and ridges leading from these to join with the low radiating ridges of the first interrarial plates. Arms comparatively large, composed of a double series of interlocking plates.

This species differs from any other described in the peculiar flat base and angular sides; the cup resembling a low, broad-bottomed, pentangular basket. Notwithstanding the flatness of the base, it is not of the type of *Agaricocrinus*, Troost, or *Amphoracrinus*.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Actinocrinus desideratus* (n. s.). Body elongate, sub-cylindrical, obconic; dome depressed-convex, and armed on the margin by five strong spines, one over each pair of arms. Basal plates unknown (apparently they were very large). First radial plates large, higher than wide. Second radial plates small, quadrangular, wider than high. Third radial plates small, larger than the second, nearly twice as wide as high, wedge-form above, and supporting in the anterior and antero-lateral rays the brachial plates, only one of which contributes to form the body, while in the postero-lateral rays they support on each side a supra-radial bifurcating plate, on each upper edge of which rests

a brachial plate, giving four arms to each of these rays, and two to each of the first, making the brachial formula  $\frac{2}{4}\frac{2}{4} = 14$ .

First interrarial plate eight sided, less than half the size of the first radial plates, supporting two narrow, elongate plates, one six-sided and one four-sided. First anal plate equal to the first radials, heptagonal, supporting three smaller plates in the second range; the middle one heptagonal, twice as large as the lateral ones, and supporting on its upper edges two small plates which extend to the small aperture. The anal area is low, composed of few comparatively large plates. Dome composed of medium sized, sub-nodose plates, surrounding the bases of the spines, with one large and more elevated plate above the anal area. Surface of body plates smooth; first radial and first anal plates depressed-convex.

This species is of the type of *A. Missouriensis*, (Report of Missouri Geol. Survey, pl. 8, fig. 1;) but differs in the form of the body, which is more cylindrical and less spreading above,—in the arrangement of the arms, the less protruding anal area, and the body plates being without nodes.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Actinocrinus clivosus* (n. s.). Body urn-shaped, spreading above the first supra-radials to the arm bases; dome moderately convex, composed of rather large plates, and surmounted by a sub-central proboscis. Basal plates large, massive, irregularly thickened, and projecting over the column, the base of each plate being deeply concave, the angles extending below, and separated at the sutures by a deep indentation, which gives six pendent angles to the base. First radial plates of height and width nearly equal; second radial plates comparatively small, quadrangular or sub-pentagonal; third radials smaller than the second, hexagonal or heptagonal, very obtusely angular

above, supporting on each upper face a small supra-radial, which sustains on the outer face a series of brachial plates, and on the inner face a supra-radial plate of the second order; this supports a brachial plate on its inner face, and apparently a supra-radial of the third order on the outer face. (There may be still other supra-radial plates not seen in the specimen.)

First interrarial plate less than half as large as the first radial plate, hexagonal or heptagonal, supporting two small plates in the second series, and one in the third. Anal plates undetermined.

Surface of plates marked by strong transverse nodes on the radial series, and rounded nodes on the interrarial plates, connected across the sutures by strong angular or rounded ridges. The basal plates, in addition to the form of the base and projecting angles, are margined on each lateral face by a strong ridge, with a corresponding ridge down the centre, dividing it into two areas which stand obliquely to each other, and have a low rounded node in the centre of each one. The plates of the dome and those of the proboscis for some distance above its base are marked by long, strong, curved spines; the proboscis in the middle and upper parts is composed of very short, wide plates, marked by transverse ridges, giving a crowded, wrinkled aspect to the surface. Column composed of round plates; every fourth or fifth, and near the top every second or third plate, is much larger, and marked at intervals by strong nodes, which give it a general pentangular form in the upper portions.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of B. J. Hall.*

*Actinocrinus chloris* (n. s.). Body below the arms broadly urn-form, base truncate; dome conical, and somewhat lobed in its lower part. Basal plates with the lower margin projecting in a thin, denticulate rim, short, at least



twice as wide as high, and moderately impressed at the sutures. First radial plates proportionally large, once and a half as wide as high, the superior lateral faces very long. Second radials short, broad, quadrangular. Third radials short, broad, heptagonal, larger than the second radials, obtusely angular above, supporting on each upper face a supra-radial plate of medium size; these support on their outer sides brachial plates, and on their inner sides supra-radials of the second order, giving six arms to each ray.

First interrarial plate very large, seven or eight-sided, supporting two smaller plates in the second range; the plates above are situated between the bases of the arms, and are more properly dome plates. Anal plates undetermined. Resting upon the upper truncated sides of the first supra-radial plates, and between the second supra-radials, there is a small pentagonal plate, which is cuneate below, with its surface distinctly grooved longitudinally. Dome composed of moderate sized, polygonal plates, gradually tapering above, and continued in a large proboscis. Surface of body plates marked by two sets of radiating ridges, those on the summits of the rays and their subdivisions being stronger, highly elevated, and subnodulose; the other ridges are less conspicuous, consisting of numerous striæ, radiating from the centres of the plates to the margins, the principal ones meeting at the centre.

This species is of the type of *A. ornatus*, (Geol. Rep. Iowa, Part II. page 583, pl. 10, fig. 12;) but differs in form both of body and dome.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Actinocrinus excerptus* (n. s.). Body depressed, broadly bowl-shaped, base broad, deeply depressed. Basal plates small, concealed beneath the column attachment (except



narrow extensions between the first radial plates, as shown in the specimen described). First radial plates forming the base of the calyx, having the usual form of those of this genus, but protruding in broad, sub-triangular nodes, which give this apparent form to the plate. Second radial plates quadrangular, small, much wider than high. Third radial plates pentangular, the lateral faces very small, short, and giving a triangular aspect to the plates; these support on each of their upper sloping edges a series of two supra-radial plates, the upper one of which is wedge-form, and supports the brachial plates on each side, giving four arms to each ray.

First interradi al plate very large, equal to or larger than the first radial plates; two small plates in the second series, and sometimes a fourth plate above. First anal plate heptagonal, and smaller than the first radials, supporting three slightly smaller plates in the second range, with five small plates arranged in an arch over the central one, and one small plate below the brachial plates of the adjacent rays. Surface of plates strongly nodose, the first interradians elevated into high rounded nodes; the nodes of the other plates are smaller and transverse; entire surface granulose.

Of this species we have only the calyx below the arms; but the broad triangular projections of the first radial plates, the depressed base, and the obscuring of the basal plates by the column attachment, are peculiar features. The basal plates are protruded along the suture lines of the radial plates in narrow linear extensions, giving a stelliform aspect to this part when the column is removed.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Actinocrinus clarus* (n. s.). Body very broadly sub-turbinate, spreading more rapidly above the third radial

plates, truncate at base. Basal plates short, scarcely thickened at the lower margins, projecting but little beyond the column. First radial plates of moderate size. Second radial plates varying from quadrangular to hexagonal. Third radial plates usually larger than the second, varying from pentagonal to heptagonal, wedge-form above, and supporting on each upper side a bifurcating supra-radial plate, on the outer side of which rests a series of brachial plates, and on the inner side a supra-radial of the second order; this supports brachial plates on each side, making the brachial formula  $\frac{6}{6} \frac{6}{6} = 30$ .

Interradial series consisting of four or five plates each, the first large, seven-sided, supporting two smaller plates in the second range, one seven-sided and one six-sided, with one or two small plates above. The anal series consists of seven or eight plates; the first hexagonal, little smaller than the first radial plates, supporting two in the second range, little smaller than the first interradian plates; three in the third range; with the others irregularly placed above. Dome and arms unknown. Surface of body plates elevated into strong angular nodes, sometimes marked by low ridges in the lower part; the nodes of the upper part connected by a strong angular ridge.

This species is of the type of *A. multibrachiatus*, (Iowa Geol. Rep. pl. 10, fig. 10;) but differs in its spreading form and angular nodes.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Actinocrinus ventricosus* var. *internodius*. *Actinocrinus ventricosus* (Geol. Report of Iowa, Vol. I. part II. page 595, pl. 11, fig. 6).

A specimen recognizable by its structure and arrangement of plates, number of arms, etc., as of this species, presents some peculiarities of surface markings. The basal plates are extended laterally in a deeply crenulated

or denticulate rim. The ridges upon the plates are fewer than in the typical forms; the principal ones extend in rigid, elevated lines entirely across the plate, and the others are interrupted, and form rounded, bead-like elevations in the intervals between the centre and sides of the plates. The plates are less convex in the centre, and not deeply indented at the sides. The dome maintains the form of that in the described species.

The features here noticed, if observed without considering intermediate varieties, might lead to the inference that it is a distinct species.

In the collection before me, there are numerous individuals of the typical form and surface markings, while others have these markings so far subdued as to present only the denticulate margin, and another form shows the plates strongly elevated in the centre, with a few sharp, angular ridges, for the most part one to each face of the plate, and the intermediate spaces along the margin deeply indented or excavated, leaving the central prominence with a much smaller area than the prevailing forms of the species.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of Dr. O. Thieme.*

*Actinocrinus ventricosus* var. *reticulatus* (n. s.). Form of body as in the original of the species, or even more spreading; structure above the first radials undetermined. Interradial plates in ranges of one, two, three, and two. Surface of plates moderately convex, and marked by low, sharp ridges, which at their joining or crossing leave hexagonal or polygonal depressed areas between. These ridges are of equal strength on all parts of the surface of each plate and on all the plates. These impressed spaces give a reticulate aspect to the surface of the crinoid.

It is possible that this variety, of which we yet know no perfect specimens, may prove a distinct species.

The *Actinocrinus subventricosus* of McChesney is of a



form similar to the type of *A. ventricosus*; but the body is higher, and less spreading below the arms, while it has a greater number of interrarial and anal plates, and the dome is nearly flat.

The genus *Amphoracrinus*, of Austin, includes species having the structure of *Actinocrinus*, but having the mouth lateral. This definition would embrace also those included under the genus *Agaricocrinus* by Dr. Troost, the latter name being applicable only to those with flat or concave bases, and having a somewhat peculiar arrangement of the plates at the base of the arms, while the arms themselves are usually very strong, and a characteristic feature of this group of crinoids.

*Agaricocrinus* (*Amphoracrinus*) *planoconvexus* (n. s.). Body plano-convex, basal portion flattened, with a moderately depressed centre; interrarial and anal areas slightly constricted and regularly rounded upwards at their junction with the sides of the dome; dome low, convex. Basal plates small, concealed (in most specimens) by the attachment of the column. Radial plates of moderate size; second radial plates quadrangular; third radial plates pentagonal, pointed above, supporting on each upper side a very short, broad plate, on which rest the arm plates proper.

Interrarial plates elongate, generally eight-sided, sometimes nine or ten-sided, succeeded by one and sometimes two in the second series. First anal plate sub-hexagonal, higher than wide, supporting three in the second range, the lateral ones much the larger, with several small plates irregularly arranged above, and uniting with the dome plates. Dome composed of numerous small polygonal plates, destitute of nodes; the central plate near the anal opening is largest, and slightly convex. Arms unknown; their bases very large in proportion to the size of the body, indicating great strength.



This species differs from all others of the genus in the form of the basal part, but principally in the dome, which has not tuberculous plates, as usual in this group. In the small, smooth dome plates it is somewhat related to *Actinocrinus brevis*, (Iowa Geol. Rep. pl. 10, fig. 3, and when the dome only is seen it might easily be mistaken for that fossil; but in the characters of the basal portions it is very distinct.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collections of C. A. White and Dr. O. Thieme.*

*Agaricocrinus (Amphoracrinus) bellatrema* (n. s.). Body broadly cyathiform, saucer-shaped, sometimes nearly flat to the extent of the third radial plates, somewhat protruding on the anal side; dome elevated. Basal plates small, concealed in a moderate depression for the attachment of the column. First radial plates variable in size, broader above than below. Second radial plates quadrangular, twice as wide as high. Third radial plates broad, short, pentangular, succeeded on each upper side by two or more short, broad plates, from which arise the free arms.

First interradial plates large, mostly ten-sided, sub-oval, supporting two narrow, elongate, secondary interradial plates, which reach to the arm openings. First anal plate heptagonal, supporting three slightly smaller plates in the second range, with numerous plates above. Dome plates various in size, some strongly tuberculous, the terminal one largest; those bordering the anal opening are small; those of the next range beyond are large, and produced into strongly elevated tubercles, and, in old specimens, sometimes becoming sub-clavate.

This species differs from any other, except *A. convexus*, in the greater convexity of the base, while the peculiarly ornamented anal area distinguishes it from every other.

There are in the collections eight specimens, the smallest

not more than one half inch in diameter, and the largest about one and one fourth inches, all showing the same peculiar characters more or less distinctly expressed. This variety of form and development of the parts named may lead in a larger collection to a separation as distinct species of those which are here seen to be distinct varieties.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Agaricocrinus (Amphoracrinus) excavatus* (n. s.). Body pentagonal, flat below, with the centre abruptly depressed or excavated, pyramidal above; height equal to two thirds the width. The depression of the base consists of a deep, circular cavity, the bottom of which includes the plates of the body as far as the middle of the second radial plates, while the upper part of these and the lower part of the third radials form the sides of the cavity; the space between this and the arm bases is somewhat rounded. Basal plates small, forming a pentagon. First radials hexagonal, wider than long; second radial plates wider and not so high, five and seven-sided; third radial plates proportionally very large, pentagonal, obtusely wedge-form above, supporting on each upper side a series of short, broad plates, on which rest the arm plates proper.

First interrarial plates hexagonal in the antero-lateral spaces, succeeded by two very narrow and much elongated plates in the second range, which reach from the inner margin of the cavity to the arm openings. In the postero-lateral spaces, the first interrarial plates are elongate, reaching to the top of the third radial plate, or higher. First anal plate sub-hexagonal, somewhat elongate, supporting three larger elongate plates in the second range, with numerous small polygonal plates above. The anal area is somewhat protruding, and situated about midway between the arm bases and the top of the dome. Dome composed of variously sized plates, the large ones tubercu-

lose and regularly arranged, one over the centre of each ray, and the largest at the top is sub-globose and surrounded by a circle of smaller plates. The plates of the flattened base are slightly convex; surface of all the body plates granulose or striato-granulose.

This species differs from all others in the abrupt depression in the base.

*Geological formation and locality.* In cherty layers in the upper part of the Burlington limestone, Brush Creek and Flint River, Iowa.

*Agaricocrinus (Amphoracrinus) corrugatus* (n. s.). Body irregularly flattened, discoid to the arm bases, radial series and arm bases projecting below; the upper part of the interrarial spaces somewhat contracted, and the centre of the disc or base of the cup impressed; the articular facet for the attachment of the column more deeply depressed. Basal plates small, in the bottom of the column cavity, and concealed by the first plates of the column. First radial plates hexagonal and heptagonal, nearly three times as broad at the upper as at the lower margins. Second radial plates short, quadrangular, width twice the length. Third radial plates short, broad, pentangular, wedge-form above, supporting on each side a series of two or more short, broad plates, on which rest the first arm plates.

First interrarial plates ten or eleven-sided, irregularly ovate, attenuated above. Sometimes only one plate in the second range, narrow and elongate; in other spaces the adjacent arm plates unite above the first interrarial plate. First anal plate seven-sided, (or six-sided, from the straightness of the lower side,) succeeded by three smaller plates in the second range. Dome and arms unknown. Surface of plates marked by small, irregular pits near the margin, with elevated ridges between. These pits and ridges produce a strongly corrugated appearance. The



lower part of the first radial plates is slightly depressed, and destitute of ornament, except the finely granulose texture which marks the whole surface.

These surface characters distinguish this species from every other of the genus.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Agaricocrinus (Amphoracrinus) inflatus* (n. s.). Body depressed-convex, strongly inflated on the anal side; interradial spaces somewhat depressed on the outer side; dome elevated, terminated by a large polygonal plate, which in some specimens is strongly tuberculous and in others subspiniform. Basal plates of moderate size, excavated about two thirds for the attachment of the column. First radial plates hexagonal. Second radial plates broad, quadrangular. Third radial plates short and broad, pentangular, succeeded on each upper side by a series of short, broad, plates, which support the first arm plates.

First interradial plates eight-sided, sub-circular or subovate, reaching nearly to the edge of the dome, succeeded by two small, somewhat elongate plates in the second range. First anal plate seven-sided, succeeded by three smaller plates in the second range, with numerous medium-sized plates above. Anal opening near the base of the large central node or sub-spine. Dome plates unequal, the larger ones slightly tuberculose. Arms broad at base, and from the back to the inner face less thick than in most species of this genus. Surface of body plates smooth in the young, becoming more convex in older specimens.

This species may be distinguished from *A. pentagonis* var. *convexus* (1st Supp. Iowa Geol. Rep. page 58) by the basal plates extending some distance beyond the circumference of the column, and the different proportions of the radial plates; also the interradial spaces are not contracted in that species. The peculiarity of this species consists in



its high dome and strongly inflated anal side, which has the appearance of a tumor.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

GENUS PLATYCRINUS, MILLER.

*Platycrinus elegans* (n. s.). Body small, narrowly sub-turbinate. Basal plates a little constricted near the middle, the lower sides slightly projecting; the small plate is nearly twice as long as its greatest width. Radial plates long and narrow, quadrangular, very gradually increasing in width upwards, once and a half as long as wide. The articulating scar for the attachment of the arms small, little more than one third the width of the plate, and scarcely extending below the top. Arms bifurcating on the second plate above the first radial, and each branch again dividing on the third or fourth plate above, composed of a single series of plates, alternately longer and shorter on the opposite sides; those in the upper part of the arms larger and somewhat squamous, the upper edge projecting. Tentacula arising from the longest side, apparently short and strong. Surface of plates smooth. Column small, round, composed of unequal plates.

This small and beautiful species resembles, in the appearance of the calyx, specimens of the genus *Dichocrinus*; but the base being distinctly divided into three parts places it in the genus *Platycrinus*.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa.

*Platycrinus clytis* (n. s.). Body small, broadly cup-shaped. Basal plates proportionally large, forming about one third the height of the cup. Radial plates quadrangular, height and width nearly equal; articulating scar small, occupying about one half the diameter of the plate, and extending but a short distance upon the body of the plate.

Second radial or sub-brachial plates small, sub-pentagonal, giving origin to an arm on each of the two upper sides; one of these is simple, and one bifurcates on the second plate above, giving three arms to the ray.

Arms composed of a single series of plates at base, becoming gradually double towards the upper part. Tentacula long, composed of long and comparatively strong joints. Surface of plates entirely covered with small elevated pustules. Column strong, composed of unequal, somewhat angularly elliptical plates, so arranged as to give the column a twisted appearance.

The form of the radial plates and the surface markings distinguish this species from every other in these rocks.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa.

*Platycrinus excavatus* (n. s.). Body discoid to the arm bases. Basal plates deeply impressed, forming a conical or funnel-shaped cavity. First radial plates sub-quadrangular, rapidly expanding to their upper edges, which are more than twice as wide as the lower. Articulating scar extending less than half the width of the plate, occupied by the small, sub-triangular, sub-brachial plate, and the first arm plate on each side.

Summit and arms unknown.

The suture lines of the first radial plates are profoundly grooved or channelled, with an elevated, thickened ridge extending along the lateral and basal margins, while the intermediate space is slightly concave, without other surface markings.

The surface characters of this species are so peculiar that they distinguish it from every other species known to me.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa.

*Platycrinus brevinodus* (n. s.). Body broadly cup-shaped,

nearly twice as wide as high, broadly truncate at base. Basal plates proportionally large, thickened in the middle, and extending so as to form a projecting rim to the base of the cup; this rim is ornamented on its edge by several short sub-spines. Radial plates short, broad, sub-quadrangular; the articulating facet for the attachment of the sub-brachial plate is shallow, occupying little more than half the width of the plate, and entirely occupied by the short triangular plate; this supports on each side the first arm plates.

Arms bifurcating on the second plate above the sub-brachial, the inner division again bifurcating on the second or third plate above the first bifurcation; arms composed near the base of a single series of short plates, becoming double above, where they are obtusely wedge-form at the interlocking edges. Surface of radial plates marked by three rows of small nodes, rising from the lower margin of the articulating scar, and passing one to each lower lateral angle and one to the basal margin, uniting with the nodes of the basal plates.

This small species differs from any other in these rocks in its low calyx, peculiar surface markings, and nodose basal rim formed by the projection of the basal plates.

*Geological formation and locality.* Keokuk limestone, Keokuk, Iowa.

*Platycrinus striobrachiatus* (n.s.). Body discoid to the arm bases; dome highly elevated, hemispherical. Basal plates occupying little more than one third the width of the disc, depressed in the centre around the top of the column. First radial plates expanding laterally from the base to near the middle, where they are abruptly bent upwards, the upper part forming the sides of the cup, broadly and deeply notched above, truncated on the upper lateral angles by the large interradial and anal plates. The articulating scar occupies about one half the width of the



plate, and is of an elongate, horseshoe form, broadest at the lower end, with a slightly elevated border around the lower margin; it is occupied by the clavate sub-brachial plate and the outer ends of the first arm plates.

Arms bifurcating on the sub-brachial plate, each main division again dividing on the second plate above, the inner branch again dividing on the succeeding second plate, and the middle branch again dividing on the second plate above the last, giving four arms to each main division and eight to the ray. The arms are elongate fusiform, composed of a double series of very short plates, wedge-form at the interlocking edges. Surface of arms marked by fine, interrupted, longitudinal striæ, visible only on well-preserved specimens. Surface of body plates covered by short, confluent, setiform spines, which sometimes form lines parallel to the sides of the plate; in some individuals these spines are less developed. Suture lines distinct and impressed.

This species is closely related to *P. Shumardianus*, (Iowa Geol. Rep. pl. 8, fig. 5;) it differs in the narrower radial plate, and in having two more arms to each ray.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collections of Dr. O. Thieme and of C. A. White.*

#### GENUS DICHOCRINUS, MUNSTER.

*Dichocrinus plicatus* (n. s.). Calyx globular, the greatest diameter through the radial plates at one third above their lower margin. The basal plates form nearly one half the entire height of the cup; their upper margins strongly undulated for the reception of the radial plates. Radial plates sub-quadrangular, unequal in size, wider at the lower margin, which is marked by a small, shallow scar for the reception of the sub-brachial plate. The anal plate differs from the radials in being narrower at the top.



Summit and arms unknown. Articulating facet for the attachment of the column very small, round.

Surface of plates marked by strong, deep, angular plications, four on the anal plate, four on the anterior radial plate, and three on each of the other radial plates; these plications commence at the small arm scar, and pass, one to each lower lateral angle, and the others to the middle of the lower margin; one or two incipient plications occupy the superior lateral portions of the radial plates. The plications on the basal plates radiate from the edge of the column scar, and are there fourteen in number; the six of these which pass towards the sutures between the adjacent radial plates bifurcate just before reaching the upper margin of the basal plates, the divisions uniting with those of the lower lateral angles of the radial plates. On four of the radial plates the plication which passes to the middle of the lower margin unites with a single plication from the basal plate, forming a continuous line from the arm scar to the column; while on the anterior radial and the anal plate, where there are two plications to the lower lateral margin, there are two direct plications on the basal plates parallel to the suture lines.

This species is closely allied to *D. striatus*, Owen, (Geol. Surv. Iowa, Wisconsin, and Minnesota, pl. VA, fig. 10;) but differs materially in the surface markings, being composed of a much less number of stronger plications.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collections of Dr. O. Thieme and C. A. White.*

*Dichocrinus scitulus* (n. s.). Body obconical, attenuated below, with sides in nearly straight converging lines; height about equal to or a little more than the greatest width at the top of the radial plates.

Basal plates a little swollen at the junction with the column; equal in length to the radial plates. Radial

plates a little longer than their width at top, and very gradually expanding from the lower margins; articulating scar narrow, occupying not more than one third the entire width of the plate at the summit. Sub-brachial plates two, very small, the first one quadrangular, the second pentagonal, and bifurcating with very short lateral margins.

The first arm plates longer than wide, and the arms apparently bifurcating on the second plate above; the plates in the upper part of the arms very short. Column round or round-oval above, consisting of alternating thicker and thinner joints, which are irregularly disposed in the upper part of the column, and more regularly alternating below. Surface striato-punctate.

This species has the form of *D. elegans* of De Koninck; but the sides are not as much curved, and the basal plates are equal in length to the radials. The sides are straighter, and it is more distinctly obconical than *D. lævis*; and in this respect it differs still more from *D. ovatus* of Owen.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collections of C. A. White and B. J. Hall.*

*Dichocrinus liratus* (n. s.). Body abruptly spreading, width a little more than twice the height, base broad; the columnar facet protruding and constricted above so as to give a salient margin. Surface marked by strong radiating ridges, three on each plate, radiating to the lower lateral angles of the radial and anal plates; the spaces between the radiating ridges are marked by concentric nodes, or interrupted ridges arranged in concentric lines.

The *D. ovatus* of Owen is described as having a slightly excavated facet for the attachment of the column, and the surface marked by depressed granulae. The extremely protruding base or column facet, which is constricted

above, and the strong ridges and intermediate nodes, are sufficiently distinctive.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Dichocrinus pocillum* (n. s.). Calyx goblet shaped, height and width about equal, or width a little the greater. Basal plates somewhat more than one third the entire height, very slightly protruded at the junction with the column. Radial plates sub-quadrangular, wider above than below; the postero-lateral rays narrower than the others, the proportion of length and breadth about one and a half to one. Anal plate wider than the other plates, and longer than the postero-lateral rays. The articulating scar on the upper margin occupies a little more than one third the width of the plate, semi-oval, slightly indenting the face of the plate, and margined by a thick rim.

The base of one of the arms which remains shows a short, wide, quadrangular plate, with a second short, wide, pentagonal plate anchylosed with the first; and upon the upper sloping sides of this rest the small arm plates. Column round at its junction with the body. Surface granulose or striato-granulose.

A specimen, which appears to be the young of this species, has a length from the column facet to the top of the dome of  $\frac{3.5}{100}$  of an inch; and to the top of the radial plates of  $\frac{2.5}{100}$  of an inch; with a width at the top of the radial plates of  $\frac{2.8}{100}$  of an inch; giving to the fossil, when deprived of its arms, an ovoid form.

The dome consists of few plates; one between the bases of the arms is larger, while on the anal side there are numerous small plates with a minute opening, and the whole are crowned at the summit by a plate much larger than any of those below.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*



## GENUS CYATHOCRINUS.

*Cyathocrinus latus* (n. s.). Calyx very broadly cyathiform, the width more than twice the height to the top of the first radial plates. Basal plates proportionally small, forming a nearly regular pentagon, the faces of which are slightly indented at the suture lines, covered by the summit of the column, except the salient angles. Sub-radial plates of medium size, wider than high, protuberant, three hexagonal and two heptagonal, one of these being the largest and the other the smallest of the series. First radial plates large, twice as wide as high; those of the postero-lateral rays a little shorter than the others, and proportionally wider; the upper articulating face very large, occupying more than three fourths the width of the plate.

The principal anal plate is large, quadrangular, resting on the truncated summit of a sub-radial plate; on the right side is a small quadrangular plate intercalated between the sub-radial plate on the longer lower side and the first radial plate, while the shorter sides rest against the large anal plate and the sub-radial on the right. Structure above the first radials unknown. Surface of plates of the upper part of the body strongly corrugated; the lower part of the sub-radial plates less strongly marked; this feature is subject to much variation from weathering, and sometimes appears as undulating rugose striæ. The sub-radial plates are very convex, and rendered protuberant by the thickening in the middle, while at the angles they are depressed and thinner. The rugose striæ of the radial plates radiate from near the upper margin, and are directed to the lateral and lower margins, meeting similar striæ from the sub-radial plates.

This species resembles *C. tumidus* and *C. bullatus* of the Keokuk limestone, and, in the protuberance of the sub-



radial plates, is intermediate between the two. In the form of the large anal plate, and the small intercalated quadrangular plate, it resembles the *C. spurius*, from which it differs in form of body plates, etc.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Cyathocrinus solidus* (n. s.). Body calyculate, moderately expanded from the top of the column to the free arms, somewhat broadly truncated at base by the summit of a large column. Basal plates small, tumid, width above the top of the column greater than the height, somewhat pointed above. Sub-radial plates rather large, thick, and a little gibbous, height and width nearly equal. First radial plates large, three of them twice as high as wide, the other two smaller and somewhat different in form. Second radial plates very short, quadrangular or linear, with the lateral margin attenuated. Third radial plates short, triangular or pentagonal. First anal plate large, quadrangular.

The plates have a thick, robust aspect, and the entire body is strong. Surface striato-granulate.

This species has the general form of *C. sculptilis*, (Supplement to Geol. Rep. of Iowa,) but the plates have not the strong elevations or folds, and the rhombic depressions at the junction of the plates do not constitute a feature of the body.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of Rev. W. H. Barris.*

*Cyathocrinus Hoveyi* (n. s.). Body robust, broadly calyculate or cyathiform, width once and a half as great as the height. Basal plates large, distinctly angular at the outer extremity, and about one third their length covered by the column. Sub-radials very large, length and width nearly equal, three hexagonal, the others apparently hep-

tagonal. First radial plates large, about twice as wide as high, or more, the articulating scar very wide, occupying more than half the entire width of the plate, leaving the upper lateral faces conspicuous, and giving a heptagonal form to the plate. Second radial plates short, broad, quadrangular. Third radial plates broad, pentagonal, with short lateral sides.

Arms very robust, sub-cylindrical, composed of very strong plates, two from each ray at their origin on the third radial plate; those of the anterior ray without any proper bifurcations, but throwing off branchlets alternately on opposite sides. The arms of the antero-lateral rays have the anterior division twice bifurcating; above which the divisions give off branchlets; and the same feature marks the entire length of the lateral arm of the antero-lateral ray, which is smaller than the others. In the postero-lateral arms, the lateral division of the ray bifurcates on the fourth plate, above which branchlets are thrown off as in the others. The remaining divisions of the postero-lateral rays are not known to bifurcate, (being broken above the seventh plate,) but give origin to branchlets as in the other divisions. Surface of plates granulose, undulating, the angles depressed, giving a broad ridge or elevation to the sides of the plate; these ridges radiate from the centre of the sub-radial plates, giving a stellate form to the elevated part of the plate. This feature is not always conspicuous. Column of moderate size, composed of thin, alternately larger and smaller plates, with a large perforation near the summit.

*Geological formation and locality.* Keokuk limestone, Crawfordsville, Indiana. *Collection of Wabash College, from Prof. E. O. Hovey.*

*Cyathocrinus parvibrachiatus* (n. s.). Body depressed-sub-globose. Basal plates of medium size, pentagonal, pointed at their outer extremity, and forming by their

union a pentagon with salient angles, slightly convex below. Sub-radial plates proportionally very large, hexagonal and heptagonal, length and width nearly equal, convex in the centres, with a somewhat conspicuous articulating facet for the attachment of the arms, occupying nearly two thirds the width of the plate, and somewhat concave. Anal plates unknown; but the large sub-radial plate is truncated on the top for the reception of a single large anal plate. Sub-brachial plates one or two to each ray, broad and strong, but varying in the different rays; the upper ones angular above, and supporting on their upper sides the first arm plates.

Arms composed of a single series of plates, bifurcating two or three times, rapidly diminishing in size at each bifurcation; the first division is on the first or second plate above the cuneate sub-brachial plate, the next division on the second plate above the first bifurcation; the intervening plates are sometimes very short, and give a very crowded appearance to the arms at the bifurcations. Column round, of medium strength, composed near the body of thin plates, alternating in size and thickness.

This species has the general form of *C. rotundatus*, (Iowa Geol. Rep. pl. 9, fig. 7,) but differs in the greater convexity of the body plates, the proportionally large sub-radial plates, and the rapidly diminishing arms. (This last feature may be in part due to injury sustained in an early stage of growth.)

*Geological formation and locality.* Keokuk limestone, Keokuk, Iowa. *Collection of C. A. White.*

*Cyathocrinus macropleurus* (n. s.). Body sub-turbinate to the top of the sub-radial plates, whence it rises more abruptly to the middle of the first radial plates, abruptly contracted above, truncate at base. Basal plates short, pentangular, much wider than high, forming when united a low cup, with an undulating margin and five salient



angles, between which the sub-radial plates rest. Sub-radials large, obtusely angular above and below, four hexagonal and one heptagonal. First radial plates sub-pentangular, a little wider than high, strongly indented above, marked by a medium-sized, elevated, sub-central scar for the attachment of the arm plates. Anal plates and arms unknown. Column large, round, composed near the body of very thin equal plates. Surface of plates marked by strong elevations and depressions, forming a series of ridges which originate from the basal plates, bifurcate on the sub-radials, and reunite below the scar of the first radial plates; a second set of less strong ridges unites the sub-radials across their lateral margins; a third and the strongest series of ridges unites the first radials across their lateral margins.

These ridges are formed by the bending or folding of the plates, which are thin, and afford very little substance for their attachment to each other; and this is probably the reason that there are seldom any but detached plates of this species found, while, from their frequency, it must have been a comparatively abundant species.

This species is closely related to *C. rhombiferus* and *C. sculptilis* in form; but the strong ridges and otherwise smooth surface, with its comparatively small articulating scar, distinguish it. The column is also much larger than in those species. The separated plates are strongly undulated upon the sides, with a sinuous margin. These deep sinuosities of the plates of very old specimens show spiculæ or bars of calcareous matter extending across the cavity from side to side, thus strengthening the thin joining faces of the plates.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. Collections of Rev. W. H. Bar-  
ris, C. A. White, and Dr. O. Thieme.

*Cyathocrinus incipiens* (n. s.). Calyx extremely small,



somewhat turbinate, base broadly truncate and surrounded by a somewhat large rim formed by the thickening of the basal plates. Basal plates proportionally large, pentagonal, angular above. Sub-radial plates minute, sub-hexagonal, the two adjoining the anal plate differing from the others in form. First radial plates much larger than the succeeding ones, wider than high, the upper lateral angles strongly incurved, giving the plate a sub-heptagonal form. Second and third radial plates sub-quadrangular, wider than high. Fourth radial plate pentagonal, angular above. The rays are free above the first radial plates.

Arms originating on the fourth radial plate, without true bifurcations above, but sending off branchlets from the opposite sides alternately; these, like the arms, are composed of short plates, alternately longer and shorter on the opposite sides, except near the arm base, where they are more equal. First anal plate minute, pentangular, resting upon one basal plate and between two sub-radial plates, partially supporting one first radial and the second anal plate; this is sub-heptagonal, nearly two thirds as large as the first radial. The third and fourth anal plates little smaller than the second, form not determined. Surface of plates irregularly nodose; on the sub-radials the nodes are high, and occupy almost the entire plate. The first radial plates are marked by two strong ridges, which, passing down from the upper margin, unite with ridges from the adjacent sub-radial. Column at its junction with the body pentalobate.

This species is distinguishable by peculiarities in the radial series and the arms. The radial plates are concave above and convex below, elevated along the middle and depressed at the sides, presenting an appearance of some species of *Forbesicrinus*. The plates of the lower part of the arms are also peculiar.

*Geological formation and locality.* Burlington lime-

stone, Burlington, Iowa. *Collection of Rev. W. H. Barris.*

*Cyathocrinus Lyoni* (n. s.). Calyx massive, broadly cyathiform, about once and a half as wide as high. Basal plates very small, the angles only projecting beyond the summit of the column. Sub-radial plates very large, higher than wide, three hexagonal and two heptagonal. First radial plates very large, nearly twice as wide as high; the upper lateral sides being comparatively long, and the articulating scar of moderate size, give a heptagonal outline; the articulation occupies little more than one third the width of the top of the plate. Second and third radial plates quadrangular, wider than long; the second shorter than the third. Fourth radial pentangular, with short lateral margins, acutely angular above.

Arms long and slender, two from each ray, composed of plates which are nearly as long as wide, slightly wedge-form, throwing off branchlets at intervals from opposite sides. Towards the middle, in the length of the arm, the branchlets are given off from every second plate on alternate sides, the intermediate plate being smaller. A large quadrangular anal plate is situated between two of the sub-radials and the radial plate on the right hand side; the succeeding anal plates undeterminable. Column round, of medium size, composed of thin alternating plates. Surface smooth or finely granulose.

This species differs from all others of the type in the large anal plate intercalated obliquely below the radial and resting on two sub-radials. It differs from *C. Hoveyi* in the smaller basal plates, the larger sub-radials, in having four instead of three plates in the radial series, with a smaller articulating scar, and in the longer and more slender arms, which have no true bifurcations.

*Geological formation and locality.* Keokuk limestone, Crawfordsville, Indiana. *Collection of Wabash College.*

*Cyathocrinus viminalis* (n. s.). Body small, depressed-sub-globose, nearly twice as wide as high; the greatest diameter at the top of the sub-radial plates. Basal plates small, pentangular. Sub-radial plates proportionally large, height and breadth nearly equal, hexagonal, except one on the anal side, which is pentagonal and larger. First radial plates sub-heptagonal, about equal to the sub-radials, slightly inflected at the upper lateral margins; articulating scar for the attachment of the arm small, less than one half the width of the plate, moderately impressed.

First anal plate hexagonal, with very small upper lateral faces, supporting three plates, the middle one much the larger; form and number of plates above undeterminable. The anal area extends above in the form of a short proboscis, reaching nearly half an inch above the arm bases.

Arms composed of a single series of short plates below and longer ones above, bifurcating on the second or third plate above the first radial plate; the second and third bifurcations are on the second or third plate above the preceding. One of the armlets on each main division of the ray bifurcates at some distance above its origin. The branches of the arms at their bifurcations are strongly diverging. Column very small, round, and composed, at a distance from the body, of strong, thick plates of equal size.

This species differs from *C. divaricatus* (Geol. Rep. Iowa, pl. 10, fig. 5) in its much larger sub-radial plates, and less strongly diverging arms, which also are composed of more numerous plates.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

## GENUS POTERIOCRINUS.

*Poteriocrinus dilatatus* (n. s.). Cup of body very small, broadly expanding. Basal plates minute, pentangular, slightly projecting beyond the column. Sub-radial plates small, hexagonal, except one on the anal side which is heptagonal, length and breadth about equal. First radial plates irregularly pentagonal, having one of the upper lateral angles slightly truncated by the second radial plate of the adjacent ray. Second radial plates nearly twice as large as the first radials, the plates of the adjacent rays joining at their lateral margins, very obtusely wedge-form above, supporting the plates of the arms on the sloping upper sides. Anal plates small, four seen in specimen, form not determined.

Arms two from each ray, bifurcating on the sixth plate from the base, and the outer divisions again bifurcating at the sixth plate above the first division, and again at irregular distances above. Surface of plates of the lower part of the body depressed-convex, becoming inflected at the sides as they approach the arm bases.

Proboscis large and inflated, rising from the top of the small cup, and extending nearly as high as the extremities of the arms; small and constricted near its base, and rapidly expanding until it becomes three times as large in diameter as the calyx, and terminating above in a highly convex dome, the lines of junction between the upper and lower parts being strongly angular; the lower part is composed of several series of small elongated polygonal plates, which gradually increase in size towards the inflated portion; each series of plates is traversed longitudinally by a sharp, angular, elevated ridge, which terminates on the plate on the widest part of the inflation in a lanceolate or pointed node. The plates composing the dome of the proboscis are comparatively large and elevated, each



marked by lines which form a star, the rays equalling in number the sides of the plate, across which they join those of the adjacent plates.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collections of Dr. O. Thieme and C. A. White.*

*Poteriocrinus ventricosus* (n. s.). Body broadly calyculate. Basal plates of medium size, projecting above the top of the column in a low coronated cup with five salient angles. Sub-radial plates hexagonal, one heptagonal adjoining the anal series, little wider than high. First radial plates proportionally large, irregularly pentagonal, having the upper portions of the lateral sides deeply inflected. Second radial plates smaller than the first, entirely separated from each other at their lateral margins, pentagonal and obtusely wedge-form above, supporting on their upper sides the first plates of the free arms. Anal plates of medium size; first one somewhat regularly pentagonal; second elongate, hexagonal, larger than the first; the remainder not determinable.

Arms two from each ray, bifurcating at the sixth or eighth plate from their base; the outer branch again bifurcating two or three times at irregular distances above; composed in the lower part of a single series of short, broad plates, alternately longer and shorter on the opposite sides, in the upper part becoming attenuated on the short side so as to allow the plate above and the plate below to join at the thicker margin.

Proboscis large and inflated in the upper part, reaching to near the extremities of the arms, composed of numerous polygonal plates. The plates of the summit smaller than the body plates, ornamented by numerous pointed nodes arranged so as to form a star on each plate.

Column strong, round, composed of short plates of unequal thickness.

This species resembles the last in its large inflated proboscis and the general expression of the calyx and arms, but in detail it is quite distinct. In this species, the second radials are uniformly smaller than the first, and are entirely separated from each other, while in that species the second radials are larger than the first, and united at their lateral margins; and the arm plates are more distinctly wedge-form, and not extended across as in that species. But the most striking difference is in the proboscis, which is composed of large plates in the lower part and smaller in the upper, which is the reverse of the other species; and the inflated portion appears to have been sub-globose instead of angular at the greatest expansion.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Poteriocrinus fusiformis* (n. s.). Calyx obconical, truncate at base, very gradually expanding, the diameter of the base being equal to one third and the top equal to two thirds the height of the cup. Basal plates placed upright on the top of the column, pentagonal, height equal to once and a half the width, sides sub-parallel, obtusely angular above. Sub-radial plates much larger than the basal plates, three hexagonal, two on the anal side heptagonal and larger, height and width as three and two. First radial plates comparatively small, less than one half the size of the sub-radials, pentangular, wider than high, supporting the first arm plates, which are long and narrow. First anal plate pentagonal, a little smaller than the first radial plate adjoining; the remaining anal plates and the arms above the first plates unknown.

Surface of plates smooth. Column smooth, round, rapidly tapering downwards, composed of thin, equal plates.

The body of this species has some resemblance to *Poteriocrinus Missouriensis*, but is smaller and less rap-

idly expanding, and differs materially in the proportions of the plates, especially the arm plates. It resembles in form and proportions some of the *Homocrini* in the lower formations.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Poteriocrinus Barrisi* (n. s.). Body turbinate. Basal plates unknown. Sub-radial plates of the usual form and proportions, sub-equal. First radial plates wider than high; articulating scar for the attachment of the arms very small. One anal plate only observed.

Arms slender, elongated, bifurcating several times, composed of cylindrical joints, which are once and a half as long as wide, and deeply grooved for the attachment of tentacula. One of the postero-lateral rays shows four joints below the first bifurcation of the arm, the others are obscure in this part of the specimen.

Surface of body plates marked by a series of sharp radiating ridges, one from the centre of each side of the plate joining in the centre of the plate, and the intermediate spaces occupied by similar ridges extending from each margin and converging so as to meet others from the adjacent margin on the line from the centre to the angles of the plate, forming a series of gradually diminishing rhombs; or, taking the lines upon the adjacent plates, forming a series of gradually diminishing triangles, one within another.

This species more nearly resembles *P. radiatus* of Austen, than any American species which I know; but the radiating ridges are more nearly equal in strength and more numerous than represented in the figures of Austen or De Koninck, while there is no space near the angles of the plates free from these ridges, as shown by these authors.

*Geological formation and locality.* Burlington lime-

stone, Burlington, Iowa. *Collections of Rev. W. H. Barris and Dr. O. Thieme.*

*Poteriocrinus lepidus* (n. s.). Body broadly calyculate, spreading to the base of the free arms, slightly lobed from the incurving of the upper lateral angles of the first radial plates. Basal plates very short, pointed above, extending between the sub-radial plates; three fourths of their diameter covered by the large pentalobate column. Sub-radial plates of moderate size, wider than high, three hexagonal and two sub-heptagonal, these being slightly larger than the others. First radial plates larger than the sub-radials, a little more than once and a half as wide as high, sub-pentagonal, the upper lateral angles of four of them inflected, so as to give a somewhat heptagonal form; the fifth is quadrangular, with an apparent hexagonal form, produced by the same cause. In at least four of the rays there have been three radial plates, the two upper ones free, and the last one bifurcating; the second radial is short, quadrangular. Anal plates four (in the specimen), the first irregularly pentangular, resting upon two sub-radial plates, and supporting on the right side the first radial plate; the second anal plate rests upon the truncated upper face of the sub-radial plate, and between the first anal and first radial plate on the left; the third anal plate rests upon the first and second, and the fourth anal plate upon the summit of the second. Arms unknown. Surface striato-granulose, the angles of the plates depressed, giving a narrow indentation at these points.

This species somewhat resembles *P. calyculus*, but is broader and much less constricted at the sides of the first radial plates, and all the body plates are much wider in proportion to the height. In that species also there are but two radial plates, the second very long, equal in length to the second and third radial plates of this species in an individual twice as large.



*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

GENUS ZEACRINUS.

*Zeacrinus scoparius* (n. s.). Body small, broadly cup-shaped. Basal plates small, scarcely reaching beyond the circumference of the column, forming by their union a pentagon. Sub-radials small, height and breadth nearly equal, three pentagonal and two heptagonal, (apparently hexagonal from the straightness of the lower sides). Radial plates four in the anterior ray and two in each of the others. First radials pentagonal, proportionally large, width twice the height. Second radial in the anterior ray quadrangular, width and height sub-equal; the third very short, quadrangular; the fourth pentagonal, like the second in the other rays, but not so high. The last radials support on their upper faces the arms, two from each ray. The arms bifurcate on the sixth or eighth plate above, in the postero-lateral and antero-lateral rays. The outer branch of each division again bifurcates at about half the length. In the anterior ray the arms bifurcate on the eleventh or twelfth plate, apparently simple above. First anal plate pentagonal, slightly elongated; second and third hexagonal; form of fourth and fifth not determined. Column round, slender, composed in the upper part of short, equal plates, below often throwing out branches from larger and thicker plates than the intervening ones. Surface smooth or very finely granulose.

This species resembles *Zeacrinus elegans* and *Z. ramosus*, (Iowa Geol. Rep. pl. 9, figs. 2 and 3,) but differs very materially from either in the mode of growth and bifurcation of the arms.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

## GENUS SCAPHIOCRINUS.

*Scaphiocrinus spinobrachiatus* (n. s.). Body small, broadly calyculate. Basal plates small, pentagonal, pointed above, extending laterally from the column, with the outer ends curved abruptly upwards. Sub-radial plates of moderate size, length and breadth about equal. First radial plates comparatively large, twice as wide as high, lateral margins short, the upper face slightly concave. Second radial plates short, broad, strongly pointed above, constricted in the middle, supporting on the upper edges the first arm plates, which are much stronger than the succeeding ones. Anal plates unknown.

Arms two from each ray, very long, simple, composed of a single series of short plates alternately longer and shorter on their opposite edges, ornamented on the longest side by one or two strong, elevated nodes or sub-spines. Surface of calyx plates moderately convex; the sub-radials more elevated than the others, marked by a series of abrupt depressions at the junction of the angles of the adjacent plates, as if the angle of each one were excavated.

In the specimen described the arms are preserved to the length of about three inches, and are still imperfect and scarcely less in size than at their base.

This species is distinguished from others by the spinous structure of the arm plates.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Scaphiocrinus Whitei* (n. s.). Cup very small, symmetrically turbinate from the column to the top of the first radial plates. Basal plates minute, strongly angular, pointed at the top. Sub-radial plates small, four hexagonal and one heptagonal, a little higher than wide. First radial plates of moderate size, irregularly pentagonal, strongly angular below, upper margin straight, extending the full

width of the plate. Second radial plates much higher than wide, strongly constricted just above the middle, entirely separated from each other, very obtusely wedge-form above, supporting on the upper faces the first arm plates. First anal plate small, hexagonal; second very small, apparently quadrangular; third larger than the second, form not determined.

Arms two from each ray, in the anterior ray bifurcating on the eighth and tenth plate above, in the antero-lateral ray bifurcating on the twelfth plate above, and in one division of the postero-lateral ray bifurcating on the eighth plate; simple above the first bifurcation; composed of a single series of round, short, unequal joints, which are abruptly thickened and projecting at the upper margins, extended laterally on the long side for the attachment of the tentacula, giving a peculiar zigzag appearance to the arms. Tentacula long, rounded on the back, thickened at the joints.

Surface of cup marked by deeply impressed pits, arranged in two series; one series at the junction of the sides of the sub-radials with the points of the basal and lower angle of the first radial plates; the other series between the first radial plates. Column of medium size, distinctly pentagonal, composed of alternating thick and thinner joints, crenulated on their surfaces.

This is a small species of the type of *P. rhombiferus*, Owen, (Geol. Surv. Wisconsin, Iowa, and Minnesota, pl. 5 D, fig. 2;) but differs in the less spreading cup, and in the deep pits, as well as in being destitute of other surface markings.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Scaphiocrinus ramulosus* (n. s.). Body shallow-calyculate, base small, abruptly concave, the basal plates concealed by the summit of the column in the bottom of the



depression. Sub-radial plates of medium size, three apparently pentangular from the straightness of the lower side, the other two larger and hexagonal from the same cause. First radial plates larger than the sub-radials, and nearly twice as wide as high, the upper margins slightly concave. Second radials long, pentangular, much higher than wide; those of the postero-lateral rays slightly truncated at the summit, the first arm plates resting on the lateral slopes of the same and widely divergent. First anal plate elongate, pentangular, placed obliquely between two sub-radials and the first radial of the right postero-lateral ray; the remaining two or three plates seen are minute.

The arms, as far as known, bifurcate on the second radial, the divisions widely divergent, with one or two (perhaps more) bifurcations above, which are less strongly divergent. The first arm plates the longest and strongest; those above are short and wedge-form, strongly rounded on the back, giving a semi-cylindrical form to the arm and its divisions.

This species is closely allied to *S. divaricatus* of the Warsaw limestone; but differs in the more concave base, and the larger and longer second radial plates; the bifurcations take place on the sixth and eighth plate, and are more numerous, and the arm plates are more rounded on the back.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of Rev. W. H. Barris.*

*Scaphiocrinus Halli* (n. s.) Body small, calyx short, broadly cup-shaped. Basal plates small, pentagonal, angular at the top. Sub-radials hexagonal, except on the anal side. First radials of medium size, pentagonal, about once and a half as wide as high. Second radials elongated, strongly constricted at the middle, and somewhat



acutely angular above, supporting on each upper margin the arm plates. Anal plates undetermined. Arms strong, simple from their origin on the second radial plate, very long in proportion to the size of the body, angular on the back, composed of a single range of plates alternately longer and shorter on opposite sides; each plate is furnished, on the longer side, with a strong process projecting laterally for the attachment of the tentacula, giving a zig-zag appearance to the arms; tentacula long, composed of strong plates. Surface of calyx plates granulose or striatogranulose.

This species differs from any other described in the peculiar structure of the simple arms; the projections for the attachment of the tentacula give an oblique direction to the plates, and this feature alternating in successive plates gives an apparent spiral form to the arm. The tentacula are comparatively strong, the lower joints a little longer than wide, and nearly as long as the arm joints.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of B. J. Hall, Burlington.*

*Scaphiocrinus tortuosus* (n. s.). General form and proportions of body similar to the preceding, the basal plates being somewhat larger, the sub-radials and first radials are of nearly the same form and proportions; second radials a little shorter and broader in the upper part, single in the antero-lateral and postero-lateral rays, while in the anterior ray there are two plates in this position, the length of both but little greater than the one in the other rays, and of less width.

Arms simple throughout their entire length; the plates short, concave on the short side and strongly angular on the longer side from the projecting bases for the attachment of the tentacula. Surface of calyx plates marked by a series of ridges radiating from the centres of the

sub-radial plates and uniting with those of the adjoining plates at the sutures; these ridges form a star on each sub-radial plate, the figures on the others varied according to the size and shape of the plates.

In general aspect this species is like the preceding. The stelliform ridges of the body plates are strongly distinctive, and the angular ridges or projections on the arm plates give a more directly transverse aspect to these parts, and produce a more abruptly tortuous or zigzag appearance than in the preceding species, while the spiral aspect is not observable.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa.

*Scaphiocrinus carinatus* (n. s.). Body small, basal plates entirely covered by the column. Sub-radials three pentagonal and two hexagonal, the one on the anal side larger. Radial plates three in each series: the first of moderate size, sub-pentangular, a little wider than long; the second quadrangular, height nearly as great as the width; the third short, pentangular, acutely wedge-form above, supporting the first arm plates. Arms two from each ray, bifurcating on the eighth or tenth plate, and in the anterior ray, and at least one of these branches from each arm again bifurcating; and a similar bifurcation is seen on one of the antero-lateral rays.

First anal plate elongate, pentagonal, resting on two of the sub-radials, and supporting one of the first radials; second anal plate larger than the first, hexagonal; the third of the same form and smaller; above these are ten or twelve plates, marked by stelliform ridges, forming the lower part of the proboscis. Surface of body plates marked by strong radiating ridges, giving a stelliform aspect. Arms composed of a single series of plates, short, and concave on the shorter side, the longer side marked by a protuberance, below which it is concave; from this

protuberance the tentacula proceed. These plates are traversed longitudinally by sets of ridges, the central one more prominent and sharply carinate, the lateral ones less distinct. Column proportionally strong, distinctly pentangular, composed of equal plates with thin projecting edges.

This species differs from the two preceding in the proportional size of the column, which conceals the basal plates, in having three radials in each series, in the smaller first radials, the more numerous bifurcations of the arms, and the sharply carinated plates.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of Rev. W. H. Bar-  
ris.*

*Scaphiocrinus orbicularis* (n. s.) Body below the arms very broadly basin-shaped, or depressed-hemispheric, with the upper margins slightly inflected; articular scar for the column attachment sharply impressed, extending one half or two thirds the diameter of the basal plates. Basal plates pentagonal, obtusely angular above, forming by their union a pentagon with scarcely concave margins. Sub-radial plates exceedingly large, extending from the edge of the column to near the top of the first radial plates, three sub-pentagonal and two heptagonal (or hexagonal from the straightness of the lower sides), length somewhat greater than breadth. First radial plates proportionally small, sub-triangular; the lateral edges of the adjacent plates slightly truncating each other. First anal plate large and massive, pentagonal, resting between the two heptagonal sub-radials, and supporting one side of the adjoining first radial plate. The two remaining anal plates (all which are seen in the specimen) are smaller and hexagonal.

Arms and column unknown. Surface of plates depressed-convex, sutures distinctly marked. The body



plates are very massive, the internal cavity being less than half the whole diameter.

This species differs remarkably from any known species in the sub-carboniferous rocks of this country. Its nearest relations are with *Cyathocrinus pentalobus*, (Iowa Geol. Rep. pl. 25, fig. 5,) = *Graphiocrinus quatuor-decim-brachialis* of Lyon, (Kentucky Geol. Rep. pl. 1, fig. 2;) from which it differs in the greater disproportion in the size of the plates, which are not produced in nodes or tubercles.

*Geological formation and locality.* Keokuk limestone, Keokuk, Iowa. *Collection of C. A. White.*

*Scaphiocrinus doris* (n. s.). Body narrowly calyculate, base truncate, the sides gently expanding to the top of the first radials. Basal plates small, about as high as wide, obtusely angular above. Sub-radials proportionally large, the height one fourth greater than the greatest width, three hexagonal and two heptagonal. First radial plates much smaller than the sub-radials, wider than high. Second radials elongate, pentagonal, obtusely angular above, and strongly contracted on the sides just above the middle. Anal plates large; the first pentangular, resting upon two sub-radials, and partially supporting the right radial plate; the second anal rests upon the truncated top of the sub-radial plate; the form of this and the succeeding one not determined.

Arms double from their origin; those of the anterior ray bifurcating on the tenth plate, those of the antero-lateral rays bifurcating on the eighth or tenth plate, and those of the other rays bifurcating at about the same distance; the plates below a little longer than wide, shorter above the first bifurcation, contracted in the middle, and thickened at the extremities. Proboscis large and strong, extending at least two and a half inches above the first radial plates.

Surface of sub-radial plates each marked by two strong



folds, extending from the centre to the upper sloping margins, those of the two adjacent plates converging, and meeting corresponding elevations on the two lateral sloping margins of the first radial plates; and these, uniting just below the upper truncate margin of the plate, give it a strongly thickened upper side, upon which the second radial rests; less conspicuous folds or elevations mark the other plates; and the entire surface is marked by sharp, slender, radiating striæ.

The body of this species might be mistaken for *Cyathocrinus rhombifer* of Owen, or *Cyathocrinus sculptilis* of Hall, (Supp. Geol. Rep. of Iowa,) but the calyx is less spreading, the plates less robust, and the surface different, while the sub-radial plates are proportionally much larger and longer, and the first radial plates proportionally smaller. Above this point, the structure and form of parts indicate the generic distinction.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Scaphiocrinus unicus* (n. s.). Body shallow cup-shaped, broad, with moderately spreading sides, and deeply impressed base. Basal plates occupying the bottom of the basal cavity, and mostly concealed by the large column. Sub-radials of moderate size, three hexagonal, and two on the anal side heptagonal; their lower ends form the sides of the basal cavity. First radials larger than the sub-radials, nearly twice as wide as high, sub-pentangular, the upper portion somewhat projecting; articulating facet concave. Second radial plates on the anterior ray sub-quadrangular, longer on one side than on the other, supporting a single arm, which is simple throughout its entire length; those of the other rays pentangular, once and a half as wide as high, rather sharply angular above, slightly constricted in the middle, supporting on each upper sloping edge an arm, which divides into three or rarely four

branches; the first bifurcation on the eighth to the twelfth plate, the second from the tenth to the fourteenth of the outer branch; the inner branch usually simple.

First anal plate proportionally large, pentangular, resting between the sub-radials, and supporting one side of a first radial and the two anal plates. Second anal plate smaller than the first, slightly elongate, hexagonal; the succeeding plates regularly hexagonal, very gradually decreasing in size upwards, and forming by their union with others a short, strong proboscis.

Arms composed of very short plates, alternately longer and shorter on opposite sides, the longer side supporting the tentacula, which are long, very strong, and composed of cylindrical joints. Surface of plates smooth, with a series of small, deep pits at the angles of the plates.

This species may be readily distinguished from any other of the genus by the low, broad cup, the number and bifurcations of arms in the antero and postero-lateral rays, the simple arm of the anterior ray, and the peculiar pits at the angles of the plates of the body.

*Geological formation and locality.* In rocks of the age of the Keokuk limestone, Crawfordsville, Indiana. *Collection of Wabash College.*

*Scaphiocrinus nodobrachiatus* (n. s.). This species resembles the preceding in the general aspect of the arms, but they are more evenly cylindrical, the margins of the plates not thickened, or but slightly so, and each plate marked by a single rounded node, instead of two sharp or spiniform nodes to each plate as in *S. spinobrachiatus*. The arms are extremely elongated.

The characters indicated above seem sufficient to distinguish the species.

*Geological formation and locality.* In rocks of the age of the Keokuk limestone, Crawfordsville, Ind. *Collection of Wabash College.*

*Scaphiocrinus robustus* (n. s.). Body calyculate, mammillæform, rounded at base, moderately expanding from the top of the basal plates. Basal plates pentangular, pointed above, less than one half their length covered by the column. Sub-radial plates of moderate size, four equal and hexagonal, one larger and heptagonal, all wider than high. First radial plates larger than the sub-radials, scarcely equalling them in height, width nearly twice as great as the height, four pentagonal, the one in the left postero-lateral ray hexagonal. Second radials nearly as large as the first, a little longer in their extreme height, sub-pentagonal, angular above, and supporting on each upper side a simple, strong arm; the first arm plate much larger than the succeeding ones, longer on the outer than on the inner sides, which are closely joined. The arm plates above are very short, strong, slightly wedge-form, very gradually decreasing in length from below upwards. At an inch above the second radial, the width of the arm is more than twice the length of the arm plates on their longest sides. The first anal plate is nearly twice the size of the succeeding ones, and somewhat smaller than the smallest sub-radial plate, elongate hexagonal, placed obliquely on the upper sloping edges of two sub-radials, and supporting on its right upper side the lower edge of a first radial plate, and on the remaining upper sides the two succeeding anal plates, which are all that can be determined of the series. Surface of plates smooth; cicatrix of column attachment large, circular.

In some individuals the arms become thickened in the middle and contracted above, giving an elongate, fusiform character.

This species resembles *Cyathocrinus* (*Poteriocrinus*) *decadactylus* of Lyon and Casseday, but differs in having only two radial plates in each series instead of three, and also differs in the anal series as described by those au-



thors.\* Both occur in the same association, and that has also all the characteristics of *Scaphiocrinus*.

*Geological formation and locality.* In rocks of the age of the Keokuk limestone, Crawfordsville, Indiana. *Collection of Wabash College.*

*Scaphiocrinus æqualis* (n. s.). Calyx small, rather broadly expanding to the top of the first radial plates. Basal plates minute, concealed by the column. Sub-radial plates proportionally large, three hexagonal and two heptagonal. First radials sub-pentangular, three times as wide as high. Second radials as large as the first, quadrangular, broad, and short. Third radials pentangular or sub-triangular, broader than high, strongly pointed above. First anal plate less than half the size of the sub-radials and resting between them, pentangular; the succeeding ones smaller, form and number not determined.

Arms two from each ray, rising from the third radial plate, bifurcating on the sixth, seventh, or ninth plate, each division again dividing, but at a greater distance from the last, rarely branching a third time, composed of very short, wedge-form plates, the sides alternately short and long, smooth in the lower part of the arm, but above the last bifurcation becoming imbricated from the overlapping of the upper margins; branches strong below and attenuate above. Tentacula long, strong, rising from the longest side of the arm plates.

This species may be distinguished from others, which it resembles in general form, by the protuberant sub-radial plates, the three radials in each series, the less number of arm branches, and the number of arms in the anterior ray being equal to that in the other rays.

*Geological formation and locality.* In rocks of the age

\* In one specimen which I have referred to, the *Cyathocrinus decadactylus* of Lyon and Caseday, there are four anal plates visible, the lower or pentangular corresponding with the same as described by these authors.



of the Keokuk limestone, Crawfordsville, Indiana. *Collection of Wabash College.*

*Forbesiocrinus Thiemei* (n. s.). Body rapidly expanding from the base to the free arms ; five prominent ridges traversing its height along the rays ; base broadly truncated. Basal and sub-radial plates very small, only the outer ends of the latter projecting beyond the column, leaving the middle of the bases of the first radials covered by the column. Radial plates three in each series, gradually increasing in width upwards ; the first and second and sometimes the third plates of adjacent rays are united. The first and third radial plates are sub-pentagonal ; the second sub-quadrangular, the outer angles truncated by the adjoining plates. The third radial supports on its upper sides the two main divisions of the ray, which again divides on the third plate above. Beyond this the arms are simple, and composed of a single series of very short plates, strongly rounded on the back. Every third or fourth plate in the lower and every second plate in the upper part is much thickened and extended on the inner side of the arm, supporting on its upper side an armlet, which is composed of short, strong plates, large at base, and rapidly diminishing towards the end. Arm joints showing the small patelloid plates very distinctly. Surface of plates of the first radial series strongly elevated in the middle and depressed at the sides ; the last plate of the first radial series and the last of the second radial series bearing small pointed nodes. Interradial and anal plates obsolete. Column proportionally large, composed of thin plates.

The absence of interradial and anal plates in this species is a character not conformable with the genus *Forbesiocrinus*. This, together with the rudimentary basal and sub-radial plates, would seem to unite it as closely with *Ichthyocrinus* ; while the arm structure places it with

*Forbesiocrinus*, but only partially, as the genus is defined.

The very peculiar feature of armlets on one side only of the arms in place of tentacula is remarkable, but it has not been determined whether the plates of the armlets bear tentacula or not. The column has been removed, and the basal plates, in their incipient development, are as in *Ichthyocrinus*;<sup>\*</sup> while the sub-radial plates, in their outer angles, reach beyond the column facet.

The absence of interrarial and anal plates, together with the entire absence of a calcareous dome, so far as we can perceive, indicates that these parts may have been covered by a fleshy envelope.

The angular form of body, the nodose-carinate rays, and other features described, afford the most peculiar and interesting form of the genus which I have seen.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of Dr. O. Thieme.*

*Forbesiocrinus spinifer* (n. s.). Basal plates very small, the sub-radials projecting in five salient points beyond the column. First radial plates heptagonal (as far as determined); second radials hexagonal, shorter than the first; third radials triangular, with the lower side curved downwards, and the centre produced into an elongate spine, supporting on its upper sloping sides the supra-radial plates in two series of three each. The upper ones of these are bifurcating plates, bearing a short spine on the centre; each one supporting two free arms, which bifurcate or throw off armlets at intervals above. Interrarial areas occupied by a single plate each, so far as observed. Anal area unknown.

The interrarial plates are angular or sub-carinate in the middle, the first one produced into a short, spine-like node

\* See Vol. II. Pal. N. Y. page 195, plate 43, fig. 2 f.

towards the base. The supra-radial plates are likewise angular, as well as the arm plates, which are somewhat nodose. The patelloid plates are distinct in the lower part of the body, and show as simple undulations in the arms; entire surface granulose. Column large at the summit, composed of thin, alternating larger and smaller plates.

This species differs from the *F. Thiemei* in having the radial plates less distinctly angulated on the back, and narrower in proportion to the height, and in the long spines upon the third radial plates, and in possessing inter-radial plates.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Forbesiocrinus juvenis* (n. s.). Body small, sub-globose, truncated at base rather largely. Basal plates short, showing only as a thin edge of a disc outside of the column. Sub-radials of medium size, pentagonal and hexagonal, wider than high, obtusely pointed above. Radial plates four in each series: the first largest, sub-heptagonal, once and a half wider than high; second and third radials short and broad; fourth radial very broad in proportion to its height, obtusely pointed above, and supporting an arm on each side. Arms dividing on the fourth plate above, and again dividing once more at least; strong and rounded on the back, composed of a single series of short, strong plates, rapidly diminishing in size at each bifurcation. Interradial and anal series consisting of one plate each, resting upon the edges of the first radials and between the second radials of the adjacent rays, the rays becoming free above the second radial plate. The small patelloid plates are indicated by the strong curvature of the suture lines of the radial plates, becoming more distinct in the arm plates. Surface apparently smooth. Column proportionally large, rapidly tapering below, composed of thin, equal plates, with a large central perforation.



This small species is easily distinguished by the arms becoming free within the limits of the radial series, the single interradial and anal plate, and the simplicity of the arm structure.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of Rev. W. H. Barris.*

*Forbesiocrinus asteriæformis* (n. s.). The body and arms together form an irregular, five-rayed star, with the ends of the rays clavate; these are made by the radial series and the united parts of the arms, which spread almost horizontally from the body; the clavate character is given by the armlets, which are closely incurved. The lower part of the body is slightly convex; the dome appears to have been somewhat elevated. Basal plates small, and appearing only as an upper joint of the column. Sub-radials small, four pentangular and equal in size, one larger and irregularly hexagonal. Radial series consisting of four, rarely of five plates: the first of medium size, wider than high, heptagonal; the second and third broad, short, sub-hexagonal; the upper radial plate is heptagonal, very obtusely angular above. The ray beyond is composed of a double series of plates, united at their inner margins as far as the fourth or fifth plate, where they separate and form two free arms. The fourth plate of each series above the last radial plate gives origin on its outer side to an armlet, and the third plate beyond gives origin to a second armlet; the second above this supports a pair of armlets, each armlet again dividing into two, three, or four branches. This arrangement is repeated on each ray, making five different sets or clusters. Each arm or armlet is composed of a single series of short, comparatively strong plates; those above the last bifurcation appear quadrangular and equal-sided. First interradial plate elongate, heptagonal; the second range consists of



three plates; above these the plates more properly belong to the dome. Anal area similar to the interradial, except that the first plate is truncated below, where it joins the large sub-radial plate.

Surface of plates smooth. Column round, very small, abruptly expanding at its junction with the body, composed of thin equal plates. The dome appears to have spread laterally, so as to arch over the rays near the origin of the free arms in medium-sized polygonal plates. The visceral cavity has extended along the ray into the midst of the armlet bases, which may have been covered by small plates or by only a fleshy integument.

This species offers in its general features a great departure from the characters of the typical form of the genus *Forbesiocrinus*, but its three basal plates, five sub-radials, and a radial series of four plates, correspond with this genus. The small patelloid plates are also traceable in some parts of the radial series, and are usually quite distinct among the plates of the arms. This species has the rays more divergent than the *Onychocrinus* of Lyon and Caseday, and its form is that of a stellate disc. In comparing it with numerous other species of the genus, and with that form described as *Onychocrinus* by Lyon and Caseday, I can see no sufficient reason for separating it from *Forbesiocrinus*.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collections of C. A. White, Rev. W. H. Barris, and B. J. Hall.*

*Mespilocrinus scitulus* (n. s.). Body small, depressed-subglobose, cup to the top of the first radials broadly sub-turbinate, with slightly convex sides; base truncate and sharply impressed; the arms fold over each other on the summit. Basal plates minute, having when united five salient angles which extend for some distance between the sub-radial plates; the outer ends only of the basal plates

are visible beyond the basal cavity. Sub-radials of medium size, wider than high, four hexagonal, and one, on the anal side, large sub-heptagonal. First radials large, nearly as wide again as high, sub-pentagonal, with the upper lateral angles slightly truncated, upper margins concave. Second radials short and broad, quadrangular, nearly three times as wide as high, less wide than the first radials, but allowing the upper margins of these to curve around their ends. Third radials short and broad, wedge-form above, supporting an arm on each upper side.

Arms bifurcating on the second plate, simple above, as far as determined. Anal plates unknown. Surface finely granulose, the granules confluent in places, appearing like broken striæ.

This species differs from *M. Konincki* (1st Supp. Iowa Geol. Rep. p. 69) in the less distinctly globose body, its calyx being broader and more regularly expanding. The basal portion of that species is not impressed, and the basal plates form a pentagon with straight sides, making the sub-radials pentagonal instead of hexagonal; the arms also are strongly curved sidewise, while in this species they are nearly straight. The plates of the arms and radial series are likewise different in form.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of B. J. Hall.*

*Rhodocrinus Barrisi* (n. s.). Body small, sub-globose, base somewhat deeply impressed. Basal plates small, partially concealed by the column attachment. Sub-radials proportionally large, hexagonal, their lower ends forming the sides of the basal cavity. First radial plates sub-heptagonal, much smaller than the sub-radials, widest below. Second radials quadrangular and hexagonal, one fourth as large as the first radials. Third radial plates minute, sub-pentagonal, wedge-form above, and supporting on each side a series of brachial plates. Interradial series

from four to six plates, the first one much smaller than the first radial, varying from pentagonal to heptagonal, supporting two in the second and two in the third range, with sometimes a small plate above. The anal series does not differ from the interr radial so far as can be determined.

Arms two from each ray, and bifurcating at more than one third their length from the base; above this they continue simple; composed of a single series of short plates, alternately thicker and thinner on opposite margins; the thin edge is frequently so attenuate as to allow the plates above and below to touch. The tentacula arise from the longest sides, and are composed of comparatively long, cylindrical joints, each equal in height to two arm joints. Plates of the body ornamented by sharp, angular nodes and spines, which are united across the sutures by ridges; those of the sub-radial and first radial plates are equal in length to the greatest diameter of the plate. The nodes of the sub-radials are directed downwards; those of the first radials extend horizontally. The ridges which pass from the sub-radials to the first radials are strongest and most prominent, surrounding the body with a series of V shaped ornaments, in the upper part of which the first interr radial plate, with its less conspicuous ridges, forms a stellate centre. Column small, composed of alternating larger and smaller joints.

This small and handsome species is easily distinguished by the surface markings. The lower part of the calyx has a strong resemblance to specimens of the genus *Trematocrinus*; but the arms rise directly from the rays, and are entirely separated from the adjacent rays (arms) by the interr radial and anal spaces, which extend above the arm bases and are united with the dome.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collection of Rev. W. H. Barris.*



*Rhodocrinus Barrisi* var. *divergens*. Another specimen, having apparently the same surface characters of body, differs in the arm structure; although at their origin there is the same number of arms, they bifurcate near the base, and one of the divisions again divides at less than half the length of the arm, making five branches to each ray, instead of four as in the typical species. The branches at their bifurcations are strongly divergent. The arms are composed of a double series of plates, which unite on the back of the arm, as in most species of *Actinocrinus*.

With these strong points of difference, this may be classed as a variety of the preceding species.

*Geological formation and locality.* The same as the last. *Collection of Rev. W. H. Barris.*

*Rhodocrinus Whitei* (n. s.). Body sub-spheroidal, deeply and abruptly concave at base, and contracted just below the arm bases, giving an expansion to the base of the dome, which is depressed-convex. Basal plates concealed by the column. Sub-radials large, somewhat hexagonal. First radials heptagonal; second hexagonal; third heptagonal, gradually diminishing in size in the successive series; the last supporting on each upper sloping side a brachial plate, on which rest the arms proper. Interradial and anal series consisting of about ten plates each; the lower one in each pentagonal, the second series hexagonal, arranged in series of one, two, three, two, and two. The dome is composed of small, polygonal plates, and surmounted on one side of the anal area by a short, strong proboscis. Plates of the body strongly tuberculous; those of the dome with less elevated tubercles. Arms unknown.

This is a strongly marked species, with a diameter (in the larger specimens) of an inch and a half, and a height of an inch to the top of the dome. It differs from all the known carboniferous species of this country in the strong-



ly tuberculose plates, with broad, rounded, elevated surfaces. In external characters it bears some resemblance to the *Gilbertsocrinus Americanus*, (Troost,) from the Silurian strata of Tennessee. In one specimen, one of the postero-lateral rays has two radial plates instead of three, which consequently has shortened the anal area.

*Geological formation and locality.* At the junction of the Chemung rock with the Burlington limestone, Burlington, Iowa. *Collection of C. A. White.*

*Rhodocrinus Whitei* var. *Burlingtonensis*. Body of the form of *R. Whitei*. Basal plates small, lying at the bottom of the cavity, and forming by their union a somewhat regular pentagon, concave towards the middle, and entirely covered by the summit of the column when present. The sub-radial and radial plates are the same as in the typical forms.

The principal differences are in the greater number of interradial and anal plates; this, with a diameter half as great as those, has from twelve to fifteen arranged in series of one, three, three and three or four, with two or three others, and sometimes another series of two. The body plates are not so tuberculose, being regularly but highly convex.

If these characters are found to be constant, they may be sufficient to constitute a distinct species.

*Geological formation and locality.* With the preceding. *Collection of C. A. White.*

*Trematocrinus reticulatus* (n. s.). Body sub-ovoid or sub-cylindrical, slightly spreading at the arm bases; base deeply and abruptly concave. Basal plates very small, forming the bottom and about half the sides of the basal concavity. Sub-radials heptagonal, their centres forming the lower margin of the cup, the lower half curved into the cavity, and the outer half ascending. First radials heptagonal, about the same size as the sub-radials; second

radials hexagonal, less than half the size of the first; third radials heptagonal, larger than the second, supporting on their upper sloping sides the supra-radials, two of which are hexagonal, and equal in size to the second radials; the upper one of these is the foraminiferous plate, and above this are two others, the upper one of which supports the arm-like processes of the summit.

The interradians consist of six ranges of plates: the first a single pentagonal or hexagonal plate, larger than the succeeding, but smaller than the first radials; two or three in the second range; three in the third and fourth; two in the fifth; and two in the sixth; these plates are generally hexagonal, some pentagonal, and others heptagonal. The anal area differs from the interradian only in having a greater number of plates.

The summit arms are composed of a double range of semi-elliptical plates, each of them perforated by a small circular foramen. The foraminiferous areas are very small, the first plate is minute, hexagonal, succeeded by two still smaller plates, which margin the foramen. Upon the inner oblique side of the second supra-radial plate rests a sub-circular plate, with a deeply notched upper margin, which forms the base of the arms of the foraminiferous areas.

Surface marked by a series of ridges which commence on the sub-radial plates, and radiate from the centre to the sides, except on the sides adjoining the basal plates; the ridges on the radial series are much stronger and more highly elevated; they give the surface a reticulate appearance, and the minute surface markings are finely granulose.

This species is distinguished by the strong radial ridges, and the reticulate surface produced by the ridges of the intermediate plates joining with those of the ray.

*Geological formation and locality.* Burlington lime-

stone, Burlington, Iowa. *Collection of Rev. W. H. Bar-*  
*ris.*

*Codaster Whitei* (n. s.). Body ovoid, a little more obtuse above than below, base obtuse; the length of basal plate, from the central perforation to the top, is equal to the space between the base of the radial and the base of the pseudo-ambulacral areas; and the distance from the base of the pseudo-ambulacral area to the point of the plate, measuring the sloping face, is a little greater than the preceding measurements. The radial plates are as wide at the base as the length from the base to the pseudo-ambulacral areas, while at the top they are once and a half as wide as at the lower margin; the entire length, measuring along the suture line to the summit, (interradials not distinguished) is equal to the width at the top of the plate.

The pseudo-ambulacral fields are narrow and strongly elevated, with a central sulcus, which is quite distinct above, but becomes obsolete towards the lower part; composed of a double series of plates on each side, those of the inner range or ambulacral ossicula are smaller than those of the outer ranges. Towards the base the area is contracted, and the inner faces of the outer ranges of plates come in contact; the number of poral pieces in a single inner range is about twenty-three or twenty-four.

The inter-ambulacral spaces are divided by a sharply defined ridge extending from the apex of the radial plates to the summit; and between this and the pseudo-ambulacral field, the surface is marked by strong, rounded striæ, separated by deep, narrow grooves, which in the lower part are parallel to the sides of the pseudo-ambulacral field, but in the upper part diverge from this direction, and converge to the summit of the central ridge.

These striated surfaces appear to be composed of separated linear plates, like the pectinated rhombs of *Cystid-*

eans; and in one place, where broken through, they are seen to be disconnected almost to the inner face of the substance, giving the appearance of numerous thin parallel laminæ. The mouth is visible in the centre of the summit; but the anal opening is undetermined, (though visible,) from imperfection in the specimen.

*Geological formation and locality.* Burlington limestone, Burlington, Iowa. *Collections of C. A. White and B. J. Hall.*



B O S T O N

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ART. V.—*Notes on New Species of Microscopical Organisms, chiefly from the Para River, South America.*  
By LORING W. BAILEY.

IN the year 1854, the U. S. Exploring Expedition, under the command of Capt. Lee, in the course of their cruise in the brig Dolphin, collected on the eastern coast of the American continent a number of soundings and algæ, which were at that time submitted to my father, Prof. J. W. Bailey, for microscopic examination. One locality, in particular, the mouth of the Amazon and the River Para, proved very rich in rare and new species of diatomaceous and allied organisms. These were at once submitted to careful study, and arrangements made for their speedy and accurate publication. As far as I can learn, it was designed that the description of these organisms should accompany the Report of the "Cruise of the Dolphin" to Congress, and two plates were prepared in outline for that purpose. For some reason, which I have not been able to trace, neither the plates nor the descriptions have ever been published, and a few proof-copies in my possession are all that remain of the original work. As most of the

forms here found are peculiar to these localities, and are still for the most part unknown to microscopists, I have endeavored to complete the publication of these plates, by the study of the original forms in the possession of the Society, and by means of pencil notes, accompanying camera sketches, among the Memoranda of the Microscopic Collection. Most of the forms contained in the plates I have satisfactorily identified upon the slides, and have carefully verified all the descriptive notes, which accompany the sketches. It has of course been impossible for me to supply from such scanty material, and from specimens mounted nearly six years ago, all the minute details desirable in the delineation of such objects, but yet I trust sufficient is given to render the species distinct and of easy recognition. Where a doubt was entertained as to the character of surface-markings, I have considered it of more advantage to leave such details unsupplied, than to add what future and better specimens might prove erroneous.

Fig. 1. AMPHORA DELPHINA, L. W. B., nov. sp. Frustules elliptic-oblong, with broad, slightly rounded ends; valves very minutely and transversely striated; nodules very large, extending in a bar across the centre of the valve; valves in front view gibbous at the centre; outer portions canoe-shaped; aspect hyaline; terminal nodules distinct.

*Hab.* Para River.

This species, which is very rare even in this locality, in general characters resembles *Amphora lævis* of Gregory. It differs from that species in the sides in F. V. being curved outward so as to be quite gibbous, instead of being incurved as in *A. lævis*, while the nodule is much larger, and contracts towards the connecting membrane. The striations could just be seen with Spencer's  $\frac{1}{16}$  in. objective, and oblique light. With moderate powers the aspect is

hyaline. As no name was assigned by its discoverer, I have ventured to propose the above, taken from the name of the vessel by which these soundings were collected.

Figs. 2, 3. *AMPHITETRAS CUSPIDATA*, *Bail.*, nov. sp. Sides concave; lateral view quadrangular, with angles produced and rounded; cellules distinctly hexagonal; connecting membrane minutely and decussately punctate.

*Hab.* Para River, and Lat.  $0^{\circ} 45' 50''$  S. Long.  $48^{\circ} 11' 25''$  W.

I have detected several specimens of this species, and compared them carefully with *Triceratium favus*, of which several varieties occur in these soundings. Although the hexagonal areolations are somewhat smaller than usually represented in *Tr. favus*, yet in this locality there are several varieties of this species, which differ considerably in this respect; and as a five-sided variety or *Amphipentas* also occurs with similar areolation, I am disposed to regard these forms as all of one species. It is probable, also, that *Amphitetras favosa*, H. et B., which differs only in the sides being straight instead of concave, may be another variety of the same species. This form was found at the depth of thirty-three fathoms.

Figs. 4 and 5. *CYCLOTELLA KÜTZINGIANA*? —. This species, which, in the list of forms detected by him, my father doubtfully refers to *Discoplea Kützingii*, is probably a variety of *C. Kützingiana* of Smith. The central portion is large, elevated, and irregularly punctate; the striæ are minute and closely radiant, reaching the margin, but interrupted before reaching the margin by a finely undulate circle.

I would here remark, as this species of *Cyclotella* is described by some as with a punctate, and by others as with a striate margin, that either appearance may be produced, in this variety at least, by a simple change of focus; the undulate line when *in focus* appearing as if made up of

circular puncta, but when out of focus giving the margin a beautiful and delicate striated appearance.

DITYLUM, BAIL., nov. gen.

Silicious, free, simple, one-celled, bivalve, consisting of two triangular pyramids applied base to base; vertices of one or both pyramids terminating in acute spines.

Figs. 6, 10, 11. *DITYLUM TRIGONUM*, Bail., nov. sp. Two nearly equal triangular pyramids, applied base to base; base of each pyramid triangular, with the angles rounded; vertex of each pyramid terminating in an acute spine; valves punctate, in radiant interrupted lines; frustules equally bivalve, turgid; lateral view triangular.

*Hab.* San Antonio Bay, Para River, 4 fathoms.

Figs. 12-14. *DITYLUM INÆQUALE*, Bail., nov. sp. Differs from *D. trigonum*, B., in having one side turgid, the other side less turgid, and rising considerably within the margin; punctate all over.

*Hab.* San Antonio Bay.

Of this curious genus, to which the name of *Grymaia* was first given by its discoverer, two species have been detected. They differ chiefly in the inequality of the valves. In the side view of *D. trigonum*, when the spine appears as if reduced to a dot, the form very nearly resembles the same view of *Triceratium alternans*, B. Both species bear some resemblance to some forms of *Chatoceros* and *Di-cladia*.

Fig. 7. *MELOSIRA GRANULATA*, L. W. B., nov. sp. Slender; joints cylindrical and punctate in parallel rows; joints separated by narrow bands devoid of striæ, all closely connected; end of filament armed with (6) spines of greater length than the narrow bands; joints longer than broad, closely binately conjoined.

*Hab.* Para River.

I have detected several filaments and detached frustules



of this species in the surface-water of the Para, and have always found them armed with spines at the margin. In some cases these spines are considerably longer than represented in the figure. The parallel puncta are very distinct.

Fig. 8. LITHODESMIUM CONTRACTUM, *Bail.*, nov. sp. I can give no more accurate idea of this form than is afforded by the figure in the plate, as the specimen was lost before fully examined, and no notes have been found to explain it. It resembles Ehrenberg's *Lithodesmium undulatum*, but its nature and position have not been fully ascertained. A similar form was found by my father in a salt marsh near Greenport, N. Y.

Fig. 9. COSCINODISCUS? TENUIS, *Bail.*, nov. sp. Shell excessively thin and hyaline, with radiant rows of minute cells, a small central inconspicuous rosette, and a radiate margin; puncta visible with moderate powers.

*Hab.* Para River.

This species near the margin resembles an *Actinocyclus*, but shows no colors or rays in the central portion. Several specimens occur, the puncta being excessively delicate and close. The front view is represented in Fig. 9 *a*. The disc is comparatively large, but so delicate and thin as to be found with difficulty, even when its position is recorded. With the low objectives, it looks like a mere circular haze.

I cannot omit saying that I feel considerable doubt as to the genus of the form here described. I have seen and carefully studied the specimen from which the figure was taken, and have seen distinctly the characters above given; but I have also found another and more perfect form, in which there are three distinct marginal processes, which would assign the form to the genus *Eupodiscus*. This latter specimen is quite as thin and fine, with radiant rows of excessively minute puncta and a margin resembling

*Actinocyclus*. I have therefore marked the genus as doubtful, although not originally considered so. Even in the identical specimen recorded first as *Actinocyclus* and then as *Coscinodiscus tenuis*, I think I have distinctly seen at least two processes, as in *Eupodiscus*. There are several varieties of *Eupodiscus* in this locality, one nearly allied to *E. radiatus*, but with very short processes. Many of them resemble *Coscinodisci*.

Fig. 16. NAVICULA SEPTENARIA, *Bail.*, nov. sp. Minute, in general outline rhombic; sides undulated, producing seven wide parts and six constrictions; central nodule and line distinct; striæ wanting or obscure.

*Hab.* Para City.

This form, which is possibly a fresh-water species, would be easily mistaken with moderate powers for some form of *Spongiolites*; but with the highest powers it is exceedingly regular and graceful, the nodule is distinct, and the median line well marked. The only specimen seen is opaque and porcelaneous, showing with the highest powers no signs of striæ. I think, however, there can be no doubt of its naviculoid nature.

Fig. 17. PLEUROSIGMA ———, nov. sp.? This would seem to be a variety of *P. inflatum* of Shadbolt. I have been unable to find the original specimen, and can therefore only trust to the outline as originally drawn. Several varieties of this genus occur here.

Figs. 18 and 19. HYALODISCUS ———. This possibly may be a variety of *H. lævis*, from the description of which it differs only in size, but from one poor specimen I have been unable to ascertain its specific characters. It is quite small, the markings are coarse compared with those of *H. subtilis* or *H. Californicus*, and the suture irregular and jagged. The rim is quite broad, and the valves very convex. The centre is densely granulate. Possibly it may be some form of *Podosira*.

Fig. 20. NAVICULA ———. This form is doubtfully referred by its observer to *N. bacillum*, E. The sides are nearly straight, the ends rounded, the striæ transverse, close, and very faint. The median line has a faint line running through its centre, which is prominent near the ends, but grows suddenly faint at a short distance from them.

Fig. 21. NAVICULA ———. This form is probably *N. lineolata*, Ehr. = *N. serians*, K., but as neither the description nor the figures given of this species by these writers is sufficiently minute, it is difficult to recognize. In the present specimen, the longitudinal lines are distinct with low powers, and with the highest powers may be seen to be separated by transverse lines, resolvable into dots. Neither Ehrenberg nor Kützing allude to any transverse lines whatever, but they may not have sufficiently searched for them.

The next form (Figs. 22 and 23) I have been unable to find, and only retain the form in the plate that it may be identified if found at any future period.

Fig. 24. This form, I have no doubt, is *Navicula gastrum* of Ehrenberg and Kützing = *N. placentula*, Ehr. The striæ are faint, close, and slightly radiant, resolved into dots by  $\frac{1}{16}$  in. objective.

Fig. 25. BIDDULPHIA TENUIS, L. W. B., nov. sp.? Shell excessively thin, quadrangular, with the whole surface decussately punctate; puncta under low powers appear like lines; lateral view elliptic, with acute, slightly produced apices.

The form represented in Figs. 25 and 26, for which I have substituted the name of *Biddulphia* instead of *Denticella* originally assigned to it, is probably, I think, a variety of *Zygoceros Mobiliensis*, B. = *Biddulphia Baileyii* of Smith. The two, however, were probably carefully compared by their discoverer, and I therefore hesitate to abandon the distinction drawn by him. In the pencil sketch from

which this figure was taken, my father describes the frustule as "*excessively* thin, in front view quadrangular," and does not even suggest a comparison with *B. Baileyii*, Sm. The descriptions, however, closely correspond, and I can discover no good reason for their separation.

It will be seen, by reference to the plate, that no less than five forms of *Biddulphia* are represented, each with more or less of resemblance to the others. Fig. 25 very closely corresponds to the figure and description of *Zygoceeros Mobiliensis*, (Bail. Mic. Contrib. Plate 2, Fig. 34,) while Fig. 34 of the present plate corresponds closely with Fig. 35 of the Microscopical Contributions, differing only in having one spine instead of two. But the other spine is again present in Figs. 35 and 69, while in Figs. 66 and 68, which he assigns to *Zygoceeros occidentalis*, no spines whatever are apparent. As the *Z. Mobiliensis* was published in 1850, and the above not drawn until 1854, it is a little singular that the resemblance should not have been noticed. My father certainly did not regard the number of spines as of specific importance, as he assigns the same name of "*trinacria*" to both Figs. 34 and 35. To Fig. 66 he assigns the specific name of "*occidentalis*." I cannot, however, discover from the original objects any essential difference in structure, and am inclined to think that the number of the spines is not of specific importance. I regard all the forms, therefore, above alluded to, as varieties of *Biddulphia Baileyii*, Sm. There is great difference in size, it is true, between these forms, but intermediate sizes are not uncommon.

Fig. 26. *EUNOTIA ANISODON*, Bail., nov. sp. Large; venter concave; dorsum convex, with two ridges symmetrically arranged, with the dorsum of each ridge composed of three subordinate ridges; ends produced and broadly rounded; striæ minute, converging slightly.

*Hab.* Para River.



Fig. 27. *EUNOTIA* ———. This is possibly a variety of *Eunotia dizyga* of Ehrenberg, but has only two teeth approximate at the middle instead of four. The striæ are fine, but distinct.

Figs. 28, 29. These were doubtfully referred to *Fragilaria constricta* of Ehrenberg = *F. undata*, S. B. D., which is represented as sometimes constricted and sometimes inflated at the middle. These two are probably of the same species, but *F. undata* is a fresh-water form. As, however, it is a widely diffused species, and occurs on this continent, this form may possibly be of identical species with the British variety.

Figs. 30 and 31. *PINNULARIA DILATA*, *Bail.*, nov. sp. Small, linear; in lateral view slightly dilated at centre and ends; ends obtuse and rounded; median band large, central nodule distinct. In front view panduriform; the constrictions meeting the connecting membrane at the centre. Striæ fine, close, and nearly parallel.

*Hab.* Lat.  $0^{\circ} 29' 58''$  N. Long.  $45^{\circ} 58' 33''$  W. Para River.

The front view of this species resembles an *Amphiprora*, the lateral view a small *P. nobilis*. It is only on turning a frustule over, that its true nature is apparent. The striæ in both views are fine and nearly parallel. The form was found at the depth of thirty-three fathoms.

Fig. 32. *STAUROPTERA* ———. This form, which is doubtfully referred to *Stauroptera cardinalis* of Ehrenberg, does not at all agree with Kützing's figure of that species, nor can I regard it as identical with *Stauroptera aspera*, which it more nearly resembles. It is not so large and stout as *S. cardinalis*, and the sides taper more, while it differs from the *S. aspera* in the striæ being lines not resolvable into dots, and of considerable fineness. Moreover the stauros is not dilated, and reaches the margin. It ap-

proaches much more nearly to *Pinnularia stauroneiformis*, which apparently also occurs here.

Fig. 33. This form I have failed in accurately determining. It bears considerable resemblance to *Navicula pusilla*, Sm., in outline, but apparently has a large and distinct cingulum passing over and around the central nodule. It also resembles a form doubtfully referred by Kützinger to *Epithemia* (*Epithemia? cingulata*, Kütz., *Bacillarien*, Taf. 29, Fig. 66). Without the corresponding front view, it is impossible to determine its nature, although I am disposed to regard it as a true *Navicula*, of a new species. The striæ are distinct, radiant, curving slightly towards the apices. The median nodule is also distinct.

Figs. 34 and 35. *BIDDULPHIA TRINACRIA*, *Bail.*, nov. sp.? I have already spoken of these forms under Fig. 25 as probably varieties of *Biddulphia Baileyi*, Smith. Fig. 35, under the highest powers, can be resolved into circular granules, decussately arranged, which are somewhat larger on the connecting zone than on the valves. The processes are also granulate to their extremities.

Another form of this singular species has the valves and connecting membrane reduced almost to a line, while there are two long processes on each valve which curve towards each other, and have between them one straight, sharp spine, somewhat longer than the processes.

Fig. 36. *SURIRELLA DUPLEX*, *Bail.*, nov. sp. Large, oblong; in front and lateral views panduriform; ends broadly rounded; median band panduriform; costæ close, distinct, and externally dilated.

*Hab.* Para River.

Fig. 37. *SURIRELLA* ———. Probably a variety of *Surirella decora*, Ehr. *Vide* Mikrogeol. Pl. XV.

Figs. 38, 39, and 40. *CAMPYLODISCUS COLLECTUS*, *L. W. B.*, nov. sp. Large, saddle-shaped; in front view un-

dulate; in side view broadly elliptic; costæ conspicuous, short, and radiant.

*Hab.* Para River, at Una.

This singular form was assigned by its discoverer to the genus *Surirella*, but I have now no hesitation in transferring it to the allied genus *Campylodiscus*. One of the chief points of interest in this species is the great width attained by the central or interstitial portion, which, in this genus, as in the *Coscinodisceæ*, is usually reduced to a narrow ring. It resembles *Surirella Campylodiscus* in some respects, and a comparison was suggested by its discoverer to *S. striatula*, Turp., but I think it is certainly entirely distinct from either.

Figs. 41-45. *DICLADIA?* MAMILLANA, *Bail.*, nov. sp. Smooth? valves sometimes equal, sometimes unequal; mammillated, turgid; one or both valves with conical mamillæ connecting at the base; valves separated by a median band not striated (?); styles and spines wanting.

Var. *a.* Valves with two cones on one side, and none on the other.

*β.* Valves with only one cone on each side. The lateral view resembles a *Hyalodiscus*.

*γ.* Valves with one cone on one side, two on the other.

*δ.* Valves with two cones on each side.

This species, which is doubtfully referred to the genus *Dicladia*, corresponds very closely to some stages of growth in *Dicladia capreolus*, as figured by Brightwell, *Mic. Journal*, Vol. IV. page 105. Moreover, Fig. 74 of the 2d Plate seems also to be but a stage of growth of *Dicladia capreolus*, from which the lower valve has been broken off. The latter are quite common in these soundings, and were figured by my father as species of *Chatoceros*. I am, however, disposed to regard them all as stages of growth of *Dicladia capreolus*. The number of mamillæ varies from one on each side to two on each side. The

valves are, I believe, smooth and imperfectly silicious. Several figures illustrating the growth of this species may be found in *Mic. Journ.* Vol. IV., Pl. VII.

Fig. 46. *TERPSINOE MAGNA*, *Bail.*, nov. sp. Very large, oblong, quadrangular, with a variable number of note-like costæ, but with no transverse bars; side view like that of *Terpsinoe musica*, Ehr.; valves minutely granulate, as in *T. musica*; connecting membrane minutely, decussately punctate.

Figs. 50, 51. *TERPSINOE TETRAGRAMMA*, *Bail.*, nov. sp. Small quadrangular; each valve marked with two inward-bent costæ; connecting membrane marked with two horizontal and one vertical bar, which do not cross the valves. Side view consisting of one large, nearly circular inflation, with two small terminal compartments; puncta fine.

*Hab. Para.*

Fig. 54. *TERPSINOE MINIMA*, *Bail.*, nov. sp. Small, quadrangular, with slightly undulate ends; valves divided into three compartments (?) by two transverse bars at each end, and one at the centre, which cross the valves and connecting membrane; valves also marked by two short costæ on each side of the central single bar.

I have here ventured to describe, as new and distinct species, no less than three forms more or less resembling Ehrenberg's *Terpsinoe musica*, Figs. 52 and 53, which also occurs in this locality. These figures were doubtless originally drawn as distinct, and were intended in part to illustrate the variability of the bars and music-like costæ. It is probable that at this time my father regarded the number of these notes as of specific importance, as appears from the names *tetragramma* and *octogramma* severally assigned to them. These can hardly now be accepted as specific characters, but in the forms here represented we have other and much more marked differences. Thus Figs. 50 and 54 differ not only in the number of constrictions, but



also materially in their internal structure. Fig. 51, the side view of Fig. 50, has only one very large median inflation, with two very small terminal inflations. The centre of the frustule in front view is divided up by transverse bars into nearly equal squares, as in *T. musica*, E., while in Figs. 46, 47, and 52, which in other respects nearly resemble *T. musica*, we find no such transverse bars. Again, in Fig. 48 there are four horizontal bars, but no vertical.

It is possible that these should merely be considered as varieties, but they were not so regarded by their discoverer, and I have concluded to describe them as distinct species. The species represented by Fig. 47 is less coarsely granulated than the varieties of *T. musica* occurring with it. The granules of Fig. 46 agree with those of *T. musica*.

POLYMYXUS, BAIL., nov. gen.

Silicious, free, simple, bivalve; in front view quadrangular, with undulate ends; in lateral view circular; valves composed of curved ridges, appearing in front view like mamillæ, but in lateral view tapering to the depressed and stellate centre; summits of ridges armed with minute spines (?).

Figs. 55-59. POLYMYXUS CORONALIS, L. W. B., nov. sp. Frustules large, symmetrical, bivalve; in front view quadrangular with mammillated ends; in lateral view circular; lateral surfaces of valves elongated into projections which in front view appear like mamillæ but in oblique view taper down to the depressed centre; summits of the elevations terminated by minute spines on the margin of the shell; valves and median band minutely punctate.

*Hab.* Para River, and mouth of Amazon.

This beautiful species, which makes up the great bulk of the soundings of the Para, seems to be confined almost solely to this one locality. I have detected one specimen

in soundings from Yeddo Bay, but this may have been an accidental admixture. Its rarity is sufficiently attested by the fact, that although seen in this locality six years ago, it is still undescribed, and I believe unknown to most microscopists. It is exceedingly beautiful, and difficult to describe. In the lateral view the centre of the valve is destitute of puncta, and is of a stellate form corresponding to the number of cones, with which it is connected by roof-like ridges. The striæ are fine, and parallel to the surface of the connecting ridges. A single valve very closely resembles a crown. Only one species has yet been noticed, in which the number of lateral projections varies from six to ten, the usual number being seven. There is also considerable diversity of size.

Figs. 60 and 61. *TRICERATIUM SHADBOLTII*, *Bail.*, nov. sp.? Sides concave; in front view constricted beneath the processes; concave sides decussately punctate; lateral surface bearing distinct rows of short, curved setæ, and three long, sharp spines, near the bases of the processes.

*Hab.* San Antonio Bay.

The side view of this beautiful species can scarcely be distinguished from *T. contortum* of Shadbolt, from which in this view, it differs chiefly in the straightness and sharpness of the spines, which project outwards. In front view, however, they are easily distinguished. The sides are concave, instead of straight, the spines are closer to the processes, and are comparatively short, projecting outwards. I regard this as of a different species from *T. contortum* of Shadbolt, with which it was carefully compared by both my father and myself. Several specimens occur in this locality. It is probable that the two figures 60 and 61 were drawn from different specimens, which would account for the difference of size. I have omitted the details of Fig. 60, as I have been unable to find a similar specimen.

Figs. 62-64. *SYRINGIDIUM AMERICANUM*, *Bail.*, nov. sp.

"Frustules minute, punctated; central portion quadrangular; valves unequal, one with a quadrate base suddenly contracted, and then tapering into a pyramidal spine, terminated by a mucro; the other valve sub-globose, with two short basal processes, each ending in a spine."

*Hab.* Para River, and mouth of Amazon.

One species of this singular genus, the *Syringidium Americanum*, has been figured in the last edition of Pritchard's Infusoria, from figures sent in letters to the authors of that work. The figure there given is much larger than the present ones, and needs no comments. One species at least, however, still remains undescribed, which may be characterized as follows.

Fig. 65. *SYRINGIDIUM SIMPLEX*, *Bail.*, nov. sp. Frustules minute, punctated; central portion quadrangular, larger and stouter than in *S. Americanum*; valves unequal, both gradually tapering into pyramidal cones, one of which terminates in a mucro, the other in a minute, sharp spine; valves nearly symmetrical; no basal processes as in *S. Americanum*.

*Hab.* Para River.

It will be noticed that Fig. 64, although called *S. Americanum* above, differs considerably from Figs. 63 and 62. I am not willing, however, to declare them distinct, as they were not originally called by different names. I have found also, from this same locality, another specimen, differing considerably from either of the above, which will be figured on some future occasion. If Fig. 64 should be considered as distinct from *S. Americanum*, I would suggest the name of "*occidentale*," which was originally given to all three of these forms.

Figs. 66-68. *ZYGOCEROS OCCIDENTALIS*, *Bail.*, nov. sp.?

Fig. 69. *DENTICELLA TRINACRIA*, *Bail.*, nov. sp.?

I have already spoken of these forms, regarding them as varieties of *Zygoceros Mobiliensis*, B.

Fig. 70. *NITSCHIA OBLONGA*, L. W. B., nov. sp. Small, linear, with sub-acute apices; valves a little narrower in the middle than at the ends, but with no central constriction; marginal puncta small, close; surface minutely punctate in transverse parallel striæ.

*Hab.* Para River.

Fig. 71-73. *ZYGOCEROS HEMITROPUS*, Bail., nov. sp.? = *BIDDULPHIA HEMITROPA*, L. W. B. Frustules large, turgid; lateral valves minutely punctate in rows, with conical processes; processes of one valve at right angles to those of the other; lateral view minutely punctate, circular, with two processes; median band straight or undulate, finely striated.

*Hab.* Para River, and Lat.  $0^{\circ} 45' 50''$  S., Long.  $45^{\circ} 11' 25''$  W.

This species is almost identical with a form figured in Smith's Synopsis as *Biddulphia radiatus*. This, however, has no trace of the spines there figured. My father has marked in Smith's Synopsis the name *B. radiatus* as incorrect, substituting for it that of *Eupodiscus radiatus*, and perhaps the above form should be referred to the same genus. It is very abundant in the soundings from the Para.

Fig. 74. *DICLADIA*? ———. I have already spoken of this form under Fig. 41. It occurs in the Para quite commonly.

Fig. 75. *GOMPHONEMA* ———. This form was doubtfully referred to *Gomphonema sphaerosporum*, Ehr., but as I have been unable to find the original form, or any very like it, I cannot compare them. The striæ are transverse, and not very close.

Fig. 76. *NITSCHIA PUNCTATA*, Bail. = *N. BRIGHTWELLII*? Kitton. I cannot discover any essential difference between the forms of these two species, and they are probably identical. *N. Brightwellii* is represented in Pritchard's



Infusoria, as somewhat larger and more coarsely marked, with the puncta arranged in circles, which I have not observed in this specimen, but in other respects they agree exactly. It is strongly punctate as at *a*, but shows no signs of striæ.

*Hab.* Para River.

Fig. 77. *NITSCHIA MESOLEPTA*, *Bail.*, nov. sp.? Small, linear in side view, with acute apices; two rows of puncta approaching at the middle; striæ wanting or obscure; valves tapering from the centre to the slightly dilated, acute apices.

*Hab.* Para River.

This form, under the name above given, was doubtfully marked as a variety of *Nitschia linearis* of Smith. It seems, however, to me, to be distinct in structure, and the latter is a fresh-water form.

Fig. 78. The scale here represented was found accompanying the original sketches, and I believe applies equally to all the figures, except perhaps to those of *Coscinodiscus? tenuis*, and the lateral view of *Polymyxus*. As the original proofs have been almost exactly reproduced, and the identical specimens could not always be found, I have been unable to verify the measurements. This scale is, I believe, equally magnified with the other figures.

I have now described as accurately as it is possible to do, from specimens which have been six years mounted in balsam, without fresh and free species to compare, the new and doubtful forms contained in this remarkably rich locality. The great bulk of the soundings consists, as I have before said, of the beautiful *Polymyxus coronalis*. Of the other species, *Cyclotella Kützingiana? Biddulphia tenuis*, *trinceria*, &c., and the different *Surirellas*, are among the more common forms; *Ditylum* and *Syringidium* are by no means rare, while *Navicula*, *Pinnularia*, and *Coscinodiscus* also

occur in considerable numbers. Many of the forms from considerable depths, as *Polymyxus*, are found also in the surface water, showing them to be recent species. I now proceed to give a list, first of the localities, and then of the species they contain.

The specimens examined are marked as follows :

No. 3. Para River at San Antonio Bay. Depth, 4 fathoms.

No. 16. Para River, off Tarpu Point.

No. 15. Latitude  $0^{\circ} 45' 50''$  S.; long.  $48^{\circ} 11' 25''$  W. Depth  $6\frac{1}{2}$  fathoms.

No. 5. Para River at Una, flood tide.

No. 11. Latitude  $0^{\circ} 29' 58''$  S.; long.  $45^{\circ} 58' 33''$  W. Depth 33 fathoms.

No. —. Para City.

The following table contains all the species observed in the above localities, and they are for the most part given with the names originally assigned to them. Those marked with stars are believed to be new, and are described in the preceding pages.

Acanthes —, fragment.	Dicladia Capreolus?
Actinocyclus.	“ mamillana, B.*
Actinoptychus senarius, Ehr.	Dictyocha fibula, Ehr.
“ denarius, Ehr.	Diploneis.
“ 13 rays.	Discoplea Kützingii, B. = Cyclotella
Amphitetras cuspidata, B.*	Kütz. Sm.
Amphora ovalis, K.	Ditylum inæquale, B.*
“ delphina, L. W. B.*	“ trigonum, B.*
Biddulphia tenuis, L. W. B.* = B. Baileyi, Sm.	“ —————
“ trinaeria, B.* = B. Baileyi, Sm.	Eunotia anisodon, B.*
“ tridentata, Ehr.	“ dizeya? Ehr.
Cerataulus turgidus, Ehr.	Eupodiscus —, B., nov. sp., allied to E. radiatus.
Coscinodiscus eccentricus, Ehr.	Fragillaria constricta?
“ gigas, Ehr.	Gomphonema sphaerosporum? Ehr.
“ lineatus, Ehr.	Grammatophora?
“ oculus iridis, Ehr.	Hyalodiscus?
“ subtilis, Ehr.	Lithodesmium contractum, B.*
“ tenuis, B.*	Melosira granulata, L. W. B.*
	“ sulcata.

Navicula bacillum? <i>Ehr.</i>	Surirella collecta, <i>B.*</i>
“ Baltica.	“ decora, <i>B.*</i>
“ lineolata? <i>Ehr.</i>	“ duplex, <i>B.*</i>
“ Lyra, <i>Ehr.</i>	“ quatamalensis, <i>Ehr.</i>
“ septenaria, <i>B.*</i>	“ splendida, <i>Ehr.</i>
“ viridis? <i>Ehr.</i>	“ striatula, <i>Sm.</i>
Nitschia mesolepta, <i>B.*</i> = <i>N. linearis</i> ?	Syringidium Americanum, <i>B.*</i>
“ <i>Sm.</i>	“ occidentale? <i>B.</i>
“ oblonga, <i>L. W. B.*</i>	“ simplex, <i>B.*</i>
“ punctata, <i>B.*</i>	Synedra acuta, <i>Ehr.</i>
Pinnularia interrupta.	“ Ulna, <i>Ehr.</i>
“ nobilis?	Tetragramma Americana, <i>B.</i>
“ dilata, <i>B.*</i>	Terpsinoe magna, <i>B.*</i>
Pleurosigma ———	“ minima, <i>B.*</i>
Polymyxus coronalis, <i>L. W. B.*</i>	“ musica, <i>Ehr.*</i>
Pyxidicula? compressa, <i>B.</i> , <i>MSS.</i>	“ Tetragramma, <i>B.*</i>
Stauroneis lineolata?	• Triceratium alternans, <i>B.</i>
Stauroptera aspera, <i>Ehr.</i>	“ comptum, <i>Br.</i>
“ cardinalis? <i>Ehr.</i>	“ favus, <i>Ehr.</i>
“ lanceolata?	“ Shadboltii, <i>B.*</i>
“ parva, <i>Ehr.</i>	Zygoceros Rhombus, <i>Ehr.</i>
Striatella.	“ hemitropus, <i>B.*</i>

To the above, most of which have been observed by both my father and myself, I can now add several other forms not observed by him. They are as follows :

Cocconema.	Cymbella.
Triceratium megastomum, <i>Ehr.</i>	Spongiolites Agaricus, <i>Ehr.</i>
Ceratoneis? spiralis, <i>K.</i>	Amphora oblecta? <i>B.*</i>
Eupodiscus crassus?	Navicula firma.
Epithemia.	Rotalia.
Hyalodiscus Californicus, <i>B.</i>	Globigerina, &c.

and several undetermined minute *Cocconeidæ*. Thus we have at least eighty-three distinct species occurring in the Para and Amazon, of which thirty would seem to be new. There are one or two other forms occurring here, which I believe to be undescribed, and which I may present at some future time. I pass now to the second portion of the plate, which includes forms also obtained during the cruise of the Dolphin, with the exception of Figs. F and G.

Figs. A, B. *AMPHORA OBTECTA*, Bail., nov. sp. Frustules in front view barrel-shaped, with straight, truncated ends; in lateral view linear-oblong, with concave venter and convex dorsum; outer portions of valves canoe-shaped, nodules wanting or obscure; whole frustule covered with close, transverse striæ, which in front view intersect fine longitudinal lines or folds in the connecting membrane, giving the shell the appearance of being woven over.

*Hab.* Lat.  $0^{\circ} 19' 05''$  N., Long.  $45^{\circ} 43' 36''$  W.

This species has the general appearance of *Amphora ovalis*, but is somewhat larger, and may be distinguished by the woven-like appearance of its striæ.

Fig. C. *AMPHIPENTAS OBTUSA*, Bail., nov. sp. Sides five, concave; angles conical; lateral surfaces slightly concave, minutely granulated; connecting membrane punctate in parallel vertical rows. Differs from *Amphipentas flexuosa*, B., MSS. in the sides being concave instead of gibbous.

*Hab.* Lat.  $0^{\circ} 19' 05''$  N., Long.  $45^{\circ} 43' 36''$  W.

This differs from *Amphitetras* only in the number of sides, and may be considered as an additional instance of their variability. The two preceding forms occur together.

*CYCLOTELLA? PULCHELLA*, L. W. B., nov. sp. Disc small, with a central umbo, from near the base of which radiate (16) dilating styliform rays, which end upon the margin in large granules.

*Hab.* Lat.  $1^{\circ} 01' 29''$  N., Long.  $46^{\circ} 17' 46''$  W.

This species, which occurs together with a beautiful form, doubtfully referred to *Synedra fulgens* by my father, I have not been able to identify. There is, however, a species of *Cyclotella* occurring in the Para, which may be a variety of this species, and well deserves the above name. It is of the same size as the present form, but from the great difficulty of removing its carbonaceous matter frequently appears opaque. I have one specimen in which there are



sixteen rays, as above, which, however, are of different colors, giving the frustule the appearance of a four-colored star. This species may be distinguished from *C. antiqua* by its large granules on the rim. It may be *C.? radiata* of Brightwell, of which I have seen no figure.

Before dismissing the interesting forms obtained in the cruise of the Dolphin, it may be well for the sake of comparison with results obtained elsewhere, and which will be noticed in a subsequent paper, to give a list of the soundings not already described. These are four in number as follows:—

1. Lat.  $1^{\circ} 01' 29''$  N. Depth 43 fathoms. April, 1852.  
Long.  $46^{\circ} 17' 46''$  W.

CONTENTS.—Calcareous nullipores and corals. When washed the following were obtained.

Stauroptera aspera.	Grammatophora.
Synedra.	Biddulphia pulchella.
Fragillaria? in bands.	Coscinodiscus subtilis.
Pinnularia interrupta.	

Many large *Globigerinæ*, and soft parts of *Polythalamia*.

2. Lat.  $2^{\circ} 36' 52''$  N. Depth 58 fathoms. Long.  $47^{\circ} 45' 02''$  W.

Nullipores and large *Polythalamia*, which, on washing, yielded many sponge spicules, abundant *Fragillariæ*, *Navicula formosa*?, *P. interrupta*, and one specimen of *Syringidium*.

3. Lat.  $0^{\circ} 20' 58''$  N. 27 fathoms. Long.  $46^{\circ} 18' 31''$  W.

Fine quartzose sand, which yielded almost nothing by drying and floating. The fine washings gave some sponge spicules, some *Polythalamia* and *Diatoms*.

Actinoptychus senarius.	Coscinodiscus lineatus.
Amphora ovalis.	Triceratium favus.
Melosira sulcata.	Biddulphia.
Navicula Lyra.	Plates of Synapta tenuis.
Stauroptera aspera.	Quinqueloculina.
Synedra.	

4. Lat.  $0^{\circ} 32' 11''$  N. Long.  $46^{\circ} 51' 25''$  W. Same character as above, with some fragments of shells.

Actinoptychus, large, with 13 rays.

Amphora oblecta.

I conclude the consideration of these forms by giving the contents of a fifth sounding, made by the United States Coast Survey in the Gulf stream.

*Gulf Stream. Position 14. 150 fathoms.*

Green mud.

Polythalamia, abundant, but small.

Coscinodiscus.

Amphora.

Triceratium favus.

" spinosum.

Melosira sulcata.

Orbulina universa.

Textilaria, very abundant.

Marginulina Bachei, small.

Strophocornus, (common.)

Triloculina.

Biloculina serrata B.\*

Spines of Echinoderms.

Fig. E. *BILOCULINA SERRATA*, B., nov. sp. Perfectly smooth, opaque, porcelaneous, globose, with serrated margin, which is distinct on the under side, and indistinct on the upper.

*Hab.* Gulf Stream 150 fathoms.

Two other forms still remain to be described, which were found in a mass of earth from Honeylake Valley, at the foot of the Sierra Nevada, which was sent to my father by Dr. Stiel. The locality contains the following forms, besides the two new ones described below.

Epithemia, nov. sp? various forms.

Gomphonema minutissima, abundant.

Stauroneis Baileyi.

Discoplea atmospherica.

Cocconeis.

Cocconema lanceolatum.

" aspera.

Cymbella gibba, B.,\* common.

Campylodiscus, nov. sp?

Tabellaria trinodis.

Fig. F. *CYMATOPLEURA ? CAMPYLODISCUS*, Bail., nov. sp. Large; lateral view almost circular, sometimes broadly oval; marginal striæ, close, short, and showing, under high powers, marginal gland-like dots. Lateral valve with one deep undulation, and surface faintly striated.

*Hab.* Honeylake Valley. Foot of Sierra Nevada.

Fig. G. CYMBELLA GIBBA, *Bail.*, nov. sp. Small; valves with very convex, almost conical dorsum; venter slightly convex; striæ fine and close.

*Hab.* Honeylake Valley.

I know nothing of the character of this locality, otherwise than by the species it contains. *Cymbella gibba*, B., is its most characteristic and abundant form.

As most of the preceding forms were discovered so long ago as 1854, it is highly probable that some, if not many of the forms here described as new, may have been seen and named by other writers. I have carefully searched all the books at my disposal, in order to avoid such multiplication of synonymes, but have found only one species, the *Syringidium Americanum*, B., which has as yet been published by other authors. I would also here say that any errors of description in the preceding remarks may be assigned to *my* observation, rather than to that of their first observer, although I have confined myself mostly to verifying his results, and have added nothing myself, of which I have not felt entirely sure. My thanks are due to Mr. Charles Stodder, of Boston, for many valuable suggestions.

In conclusion I would say, that a large amount of microscopic and botanical matter, which was in course of preparation for publication, still remains among the Memoranda of Prof. Bailey's Microscopic Collection, which I will endeavor to collect and complete at an early day.

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NOTE. — I take the opportunity afforded by a delay in publication to correct an error, which has crept into the preceding remarks, through a typographical error in Smith's Synopsis.

On page 344, the form spoken of as "*Biddulphia radiatus*" should read "*Eupodiscus radiatus*." The statement that my father corrected *Biddulphia radiatus* was caused by the name being misprinted in the edition of Smith which I used. He corrected "*Eupodiscus radiatus*, Bail.," saying that it was not his species, "or else very badly figured." Mr. Stodder is inclined to think that the species here figured is a new one, and that the name *B. hemitropa* should be retained. The form approaches so closely to one figured by Mr. Roper, (Mic. Journ., Vol. VII., Plate 2d) as to leave considerable doubt in regard to their separation, but in no instance, in the forms from the Para, have I seen any trace of spines, as represented by Roper and Smith.

On page 339, the form referred to as *Dicladia Capreolus* should be numbered 73 instead of 74.

ART. VI.— *Contributions to the Comparative Myology of the Chimpanzee.* By BURT G. WILDER.

[Presented to the Society, April 17th, 1861.]

THROUGH the kindness of Prof. Jeffries Wyman, I was enabled last winter to dissect one side of a young male Chimpanzee, *Troglodytes niger*, about two feet in height; as it had been kept in alcohol for two or three years, it could be examined more at leisure than a fresh specimen. The dissection was very carefully made, and with special reference to the differences in the muscular system from that of man. Believing the mere facts in Anatomy or any science to be in themselves worthless till so grouped and studied as to exhibit the uses or functions which they represent, I have constantly endeavored to detect the *meaning* of the differences in size, number, and arrange-

AUGUST, 1861.



ment between the muscles of the Chimpanzee and those of man, and with this view have dissected portions of six other Quadrumana of the genera *Macacus*, *Cynocephalus*, and *Ateles*, and several lower animals, using also for comparison the published or MS. notes of a large number of other dissections. (See list at the end of this paper.) I will speak first of some muscles whose functions are chiefly local, and then more in detail of the muscular system as adapted to the climbing habits of the *Quadrumana*.

*Occipito-frontalis*. The apes have been generally supposed to possess the power of moving the eyebrows and scalp, which man does by means of this muscle; in him the two muscular bellies are short, the greater part of the skull being covered by the thin aponeurosis which connects them. I have dried and preserved the right half of this muscle from the Chimpanzee which I dissected; the fleshy fibres are proportionally much longer than in man, and seem to meet upon the vertex; the occipital portion is quite fleshy and distinct, but the frontal portion is thinner and more closely united with the thick skin, so that, commencing in that region, one might very easily overlook it, as I did at first. Tyson and Traill say they could not find it in their specimens, and no other authors mention it, except Prof. Owen, who found it in an Orang (*Simia Satyrus*), and partly in a Chimpanzee. (4.) There were evidences of it in a *Cynocephalus* and in the *Macaci* which I dissected, but I did not trace it in its whole extent.

The muscles of the ear have been as little noticed by anatomists; the ear of this specimen had been cut off before I dissected that region, so that I am not positive as to the insertions into it; but in the places of the *Attrahens* and *Retrahens aurem* were series of muscular fibres converging towards the ear, their upper borders touching the lower border of the *Occipito-frontalis*; they seemed to be

more extensive than in man. On the upper surface of part of the parietal and frontal portions of the *Occipito-frontalis* may be seen a thin layer of muscular fibres, about two inches in width, near the sagittal suture, thence converging downward towards the ear. If this represents the *Attollens aurem*, it is much more extensive than in man.

Cutaneous muscles. In the Chimpanzee, as in the Gorilla and Orang, the *Platysma myoides* is rather thicker than in man, but I could find no cutaneous muscles upon the trunk as in the lower animals. There was a distinct *Dermo-humeralis* in each of the two Cynocephali and three Macaci which I dissected, and it is not mentioned as absent in the others. It is generally inserted over the tendon of the *Latissimus dorsi*, and would thus serve either to wrinkle the skin, or to assist the latter muscle to flex the humerus, as in climbing.

Digastricus. The anterior belly is much broader than in man, being composed of two portions,—one external, next the jaw bone, rounded and more directly connected with the tendon,—the other internal and twice as broad, reaching to the middle line to join that of the opposite side. The two muscles fill the space between the rami of the jaw.

Sterno-mastoid. Wholly distinct from *Cleido-mastoid*. Occipital portion very broad, the aponeurotic attachment, reaching from just behind the ear to the middle line on the superior occipital crest. Thence downward it gradually becomes narrower, thicker, and more rounded, crossing the *Cleido-mastoid* to be inserted by a short, round tendon into the manubrium, as in man.

Cleido-mastoid. This is smaller than the preceding, and the reverse in shape, the small end being above, and attached to the skull just within the anterior edge of the *Sterno-mastoid*, while the lower end is wider and inserted into the upper border of the clavicle, near the sternum. In the Gorilla, according to Duvernoy, the sternal portion

of the *Sterno-cleido-mastoid* is very small, the whole appearing as one muscle, which is almost wholly attached to the clavicle, and there are not two separable portions; but in Prof. Wyman's specimen it resembled that of this Chimpanzee.

*Trapezius*. I noticed no difference in this from the human, except that its lower border, instead of overlapping the upper border of *Latissimus dorsi*, seemed to be continuous with it, as mentioned by Vrolik, who says that this connection does not exist in other apes. Tyson's plate is not very distinct, but he does not say that it differs from the human. In the Gorilla, according to Duvernoy, it is as in man.

*Rhomboidei*. In the *Quadrumana* generally, these form but one muscle. In the Orang, and in the Inui and *Cynocephali*, (8.) the single muscle is attached to the occiput, thus serving to support the head.

*Levator-anguli-scapulæ*. Did not differ from the human; in a *Cynocephalus* and *Macacus* it was continuous below with the *Serratus magnus*, of which it would thus seem to be merely a continuation. In the *Macacus* it arose from the transverse processes of all the cervical vertebræ, and perhaps from the occiput and first dorsal vertebra.

*Levator claviculæ* (Tyson), *Trachelo-clavicular*, or *Trachelo-acromialis*. This muscle is not found in man, but appears to exist under some form in most of the lower animals. In this specimen it was quite strong, but I did not see its origin, which is generally from the transverse processes of some of the upper cervical vertebræ.

*Serratus magnus*. Composed of two fleshy parts, with an intervening thin portion. The superior part seemed to arise from the first and third ribs, thence becoming wider, to be inserted into about an inch of the upper angle and posterior border of the scapula. The inferior portion is



much larger, arising from the eight ribs below the third, thence narrowing to its insertion into the lower angle and part of the posterior border of the scapula, without any tendon. I did not see that the intervening thin portion was anything more than a thin membrane.

*Subclavius*. I am quite sure that it was present, but did not note its connections. Mr. Moore thinks he saw it on the right side of this specimen. It is generally present in *Quadruman*a, and larger than in man, in accordance with the greater mobility of the shoulder.

*Costo-coracoid ligament*. Connects the cartilage of first rib near the sternum with the coracoid process. Duvernoy thinks that this takes the place of the *Subclavius* in *Gorilla*; but they both existed in this *Chimpanzee*.

*Coraco-brachialis*. Does not seem to reach the coracoid process at all, except through the tendon of the short head of the *Biceps*, to which, and to the upper part of the muscle itself, its fleshy fibres are attached; its insertion, I think, was not more than one half an inch long, one third down the humerus. In Prof. Wyman's *Gorilla* this attachment was from the surgical neck as low down as the middle of the humerus.

Before describing the muscles employed in climbing, let us first consider how far this principal mode of locomotion of the *Quadruman*a differs from that of man.

The *Quadruman*a are all more or less perfectly adapted for climbing; but as those of the old world form two groups,—the *Anthropoids*, including the *Chimpanzees*, *Orangs*, and *Gibbons*, with very long and powerful arms and short legs, fitting them well for climbing, but poorly for walking; and the *Baboons* and *Monkeys*, (*Cynocephali*, *Macaci*, &c.) whose limbs are of nearly equal length and power, and who climb or walk on all fours with about the same facility,—so in the new world are two corresponding groups, the *Howling-Monkeys*, the *Ateles*, &c., with a



long and generally powerfully prehensile tail, all being very agile climbers; and the Cebidæ, Sakis, and others whose tail is not prehensile, and who go often upon all-fours. So much do the Anthropoids resemble ourselves in external form and in their attitudes, as we see them in captivity or represented in books, and so nearly also does their internal structure correspond with our own, that we are very apt to overlook the radical distinction in their mode of locomotion, and to believe that in this as in other respects they form the physical transition between the lower animals and man. *We* walk upright upon the earth, and our whole frame is perfectly balanced in that position; we are supported from below by comparatively narrow pedestals; our whole weight is in direct opposition to the erect position, and, as soon as we declined from it, would force us to the earth but for the preponderance in the back and legs, of the extensor over the flexor muscles. The position of the *ape* in nature is just the reverse: he hangs and moves about among the trees by means of his long arms, being thus sustained, not from below, but from above; and his weight would soon bring him to the earth but for the immense power of the *flexor* muscles in the arms. In our arms, and in the legs of the ape, the two systems of muscles are more nearly equal. Our legs are solely for locomotion, our arms solely for prehension, and both present the perfection of structure which would naturally attend so high a degree of specialization of function; but both the upper and lower limbs of the ape may be employed as organs of either support or prehension, and we therefore remark in them a corresponding want of complete adaptation to either of these functions; yet these so diverse motions of man and apes are performed by almost identical muscles, while in the bird, which, like man, walks upon two legs, with a very characteristic motion of the anterior extremities, the muscles are with great difficulty homologized

with the human. We see also that in both man and ape the greatest weight of the body is placed nearest the organs of support, which is a further proof of the inability of the former to climb, and of the latter to walk, with ease; and the depressed head of the ape, and the proportions of the neck, which is shorter than in man compared with the length of the arms, also offer the least hindrance to the free suspension and movement of the trunk by the arms. The great length of the ape's arm, especially below the elbow, however useful in climbing, deprives him in a measure of the facility we possess of touching with the fingers every portion of the body; and we should hardly wish our arms so long as to render the most convenient way of scratching the middle of the back, passing the hand between the legs, and up behind to the point desired, as has been said of one species.

So far as the arms are concerned, the climbing of the ape consists in their alternate extension towards and contraction from some point above, thus elevating the body to it. The shoulder is much more movable than in man, and has an additional elevator, *Levator claviculæ*. It is depressed by the lower part of the *Trapezius*, by the *Serratus magnus*, *Subclavius*, and *Pectoralis minor*; this latter is quite variable in its insertion, which is sometimes into the coracoid process as in man, and sometimes into the great tuberosity of the humerus; in this Chimpanzee the former was the case on the left side, but the latter on the right side. In the Gorillas of Profs. Wyman and Duvernoy the muscle was composed of two portions, of which the upper was inserted into the coracoid process, and the lower into the tendon of the short head of the *Biceps*, so that when the arm was raised, it might act as a flexor of both humerus and fore-arm. In the lower species, the muscle is generally longer than in man, and more or less subdivided, and its insertion is usually into the humerus.

The arm is raised from the side by the *Deltoid*, which is extremely thick and powerful, as is required by the length and weight of the limb; there is also an additional infra-spinous portion of this muscle arising from the fascia of the *Infra-spinatus* and from the lower third of the anterior border of the scapula, which would better enable the Chimpanzee to swing the arm backward. The *Deltoid*, *Supra* and *Infra-spinati*, *Teres minor*, and *Subscapularis* are a great protection to the joint.

The humerus is depressed, or, the hand being fixed, the body is raised by the *Pectoralis major* in front, the *Latissimus dorsi* behind, and the *Teres major* arising from the lower half of the anterior border of the scapula between them. The three are very thick and strong; the sternal portions of the *Pectorales majores* nearly touch on the middle line, but there is no division between them and the clavicular portions, though the fibres cross before their insertion as in man. The tendons of these three muscles pass round the *inside* of the humerus towards the upper surface, so as by their contraction to throw the elbow outwards, and keep the thumb and radial side of the forearm inward and upward, which is obviously the most advantageous position. In the lower species the *Dermo-humeralis*, described above, acts as a second *Latissimus dorsi*, though of course much more feebly. The scapular head of the *Triceps*, though part of the extensor, is nevertheless, when acting alone or with the other flexors of the humerus, a powerful aid in climbing, its extensor power being counteracted by the flexors of the forearm, which act at a greater mechanical advantage, so that it can then act only as a flexor of the humerus.

In man there is occasionally found as an anomaly, a muscular slip on the inside of the arm, from the tendon of the *Latissimus dorsi* to some part of the elbow; in most of the *Quadrumana*, and in very many other animals, this mus-



cle is constantly present, though varying as to size and insertion in different species; it does not seem to have been described with much accuracy; in the lower animals it is often so large as to be called the fourth head of the *Triceps*; in the *Quadruman*a it is generally named the "*slip from Latissimus dorsi to elbow*," with a conjecture that it may be of some use in climbing; this it never could be, but the reverse, acting as part of the extensor; but even if inserted into the olecranon or upon the *Triceps*, as it sometimes is, it would be of the same use in climbing as the scapular head of that muscle; but in a large number of cases it is attached to or over the internal condyle of the humerus, thus acting only to draw the arm and body together, without at all interfering with the simultaneous flexion of the forearm at the elbow. Duvernoy describes it in the Gorilla under the name of "*Dorso-epitrochlien*," and he seems to have understood its true function better than any one else. In the lower *Quadruman*a, while on all fours, as in *Quadrupeds*, this muscle simply helps to retract the fore-leg; in the cat which climbs, and in the same way as we do, by contracting the whole limb, it is inserted into the internal condyle; but in the Angora Goat, whose so-called climbing is merely a tall kind of walking, it is almost wholly attached to the long olecranon, tending thus to extend or straighten the whole limb at the same time that it pulls it backward.

The muscles which flex the arm at the elbow are the same as in man, — *Biceps*, *Brachialis anticus*, and *Supinator longus*. The two heads of the first are distinct to within an inch of the insertion, and the coracoid head is the larger. The *Brachialis anticus* is not easily separable into two parts, or as easily into several. In the *Supinator longus* we notice at once a feature which exists also in the flexors of the leg; its origin is from the two inches below the middle of the humerus, thus as high as the



*Brachialis anticus*, and much higher than in man; while this disposition of the flexors mars the symmetry of both elbow and knee; combined with the constant partial flexion of the arm and leg it confers upon the ape greater readiness and power of contraction. The length of the belly of the *Supinator longus* is to that of the tendon as five and a half to one and a fourth.

From the direction of the force, the *Supinator longus* is a very feeble supinator, much more so than the *Biceps*, which also can turn the palm fairly upward, while the former can only bring the thumb or radial side of the hand uppermost; then continuing to act, it is a simple flexor of the forearm, with of course more power the higher it is attached upon the humerus; in fact the *Supinator longus* bears the same relation to the humerus when the hand is fixed, as in climbing, that the *Biceps* bears to the forearm when the shoulder is the fixed point. Both muscles may act as either flexors or supinators; in the former case their effect as supinators must be counteracted by the *Pronator teres*, which then is also a flexor, and in the latter case the *Triceps* may be felt to contract to prevent flexion, and also to fix the ulna. The gradual disappearance in the *Quadrumana* of the power of rotating the forearm, which is so complete in man, is well described by Vrolik (7, page 30). The most natural, and therefore the most useful position of the forearm in the climbing *Quadrumana*, is midway between pronation and supination, when the *Supinator* acts freely as a flexor. While dissecting an Angora goat last winter, I was much interested to observe that the *Biceps* had two distinct tendons of insertion, of which one, representing the single tendon of man and in the *Quadrumana*, ran round the neck of the pronated radius, to be attached to its lower surface, while the other *extra* tendon was inserted at once into the upper border of the bone; this double tendon, adapted to the flexion of the forearm in its

state of permanent pronation, is a good example of the adherence to a general plan, with the addition of a part for special use, or, from the opposite point of view, of the total disappearance of a part when no longer needed. I found the same structure in a young sheep, but have never noticed it in the Carnivora. The flexors and extensors of the wrist do not differ from those in man, except that the *Flexor ulnaris* is larger, as also the pisiform bone to which it is attached. In the Chimpanzee, as in man, the *Flexor carpi ulnaris* is more powerful than the *Flexor carpi radialis*; the former is clearly the one which we use in the more forcible movements of the hand at the wrist, in striking a blow, or in reaping with a sickle; it is also full as good a supinator as the *Supinator longus*, and in nearly all actions requiring forcible supination, as turning a handle, &c., the hand is flexed to the ulnar side at the same time.

It is a general rule, that two contiguous segments of a limb are flexed in opposite directions, as is well shown in the human lower extremity, where thigh, leg, foot, and toes all bend thus contrary to each other, the flexor muscles of one segment lying, of course, on the same side of the limb with the extensors of the segment next below. This holds good in the leg and upper arm of most animals as well as man, but in nearly all, the hand and fingers, and, if the hand is supinated as in man and *Quadrumana*, the forearm also, appear to be flexed or extended in the same direction, so that two, or even three groups of muscles, which by their contraction shorten the arm, lie all upon the same side of the limb, though attached to three contiguous segments, — forearm, hand, and fingers. But to carry out the idea of “antero-posterior symmetry” or antagonism between the corresponding segments of the fore and hind limbs, the supinated hand must be placed palm downward, with the fingers pointing backward, when of course the muscles now called *extensors* of

the wrist or hand will become the *flexors*, and vice versa, and the contiguous segments will be flexed in opposite directions. During the earlier foetal periods the hand is in a state of supination, and afterwards becomes pronated, remaining so through life in the common Quadrupeds, only some, as the higher Carnivora, the Quadrumana, and especially man, having the power of freely rotating it back to its original condition, which, of course, is more likely to illustrate the true morphology than any afterwards acquired. Therefore, the muscles on the front of the forearm attached to the wrist are *morphologically extensors*, although they will probably retain the *functional* name of *flexors*, since by their contraction they shorten the limb. In the leg of man, the above rule obtains even as to the slight lateral deflection at the joints, for the hip stands outward, the knee inward, and the ankle again outward, so that the sole of the foot may be *inverted* more easily than *everted*, as is more strikingly shown by the permanent condition of the foot in the ape, in whom, however, the rule is infringed by the peculiar outward curvature of the whole limb for greater facility in climbing. So when the arm is placed in the position indicated above, the shoulder stands outward, the elbow inward, and the wrist again outward, the hand bending more naturally to the ulnar than to the radial side; and accordingly we find the *Flexor carpi ulnaris* more powerful than the *Flexor carpi radialis*, and the hand of the Bird is permanently flexed to the ulnar side. The use of the "antero-posterior symmetry" between scapula and ilium, humerus and femur, forearm and leg, in the common Quadrupeds, for better balancing the body when at rest, is evident; but since the animal when moving goes forward, the hand is pronated so that the two lower segments, which are often much elongated, both bend backward, affording a more extensive motion in that direction for propelling the body forward. But in the hind leg the segments below the knee, and in-



deed below the hip, possess little separate motion, the entire limb swinging nearly as a whole.

The tendons of the deep common flexor of the fingers, (*Flexor profundus digitorum*) were so short as not to permit the simultaneous extension of both hand and fingers; the latter could be straightened only when the former was at right angles with the forearm, and when I bent the hand back into a straight line the fingers closed tightly upon mine. The advantage of this to a climbing animal is at once apparent; the hand having been placed upon a branch, the mere weight of the body would cause the fingers to close upon it like hooks without muscular exertion, and they would retain their grasp till the strain was relieved by means of the other limb. How else can we explain the power which some Orangs have been said to possess, of swinging upon a rope by the hands alone, for an hour at a time? It also readily accounts for the Anthropoids not being able to apply their palms to the ground when on all fours, but being obliged to rest on the knuckles. I have never seen any direct reference to this structure, but it has always been remarked that the digits of both hands and feet of the Anthropoids are generally flexed, giving them a hook-like appearance. By a similar structure, though not nearly so marked, the human hand may be bent backward a little farther when the fingers are flexed than when they are straight; and, the reverse of what exists in the Chimpanzee, owing to the shortness of the *extensor* tendons, man's hand and fingers cannot be flexed far together, but by bending forward the closed fist the fingers are gradually forced open.

In general, the muscles lying upon the forearm differ from our own in being less distinct from each other, and in remaining fleshy often to the wrist, allowing more extensive movements, but detracting much from the elegance and pliability of the limb.

*Extensor communis digitorum.* May be separated into



three fleshy parts to above the middle of the arm, and the part supplying the index finger still higher; this becomes tendon at the wrist, the middle portion about an inch higher, while that going to the ring finger is the largest, and continues fleshy below the end of the ulna; the tendon of the middle one is the largest. The *Extensor minimi digiti* is separate from the preceding as high as the part supplying the index finger; it is slender, but continues fleshy below the wrist. Neither Mr. Moore nor I found any tendon from the *Extensor communis* to the little finger, nor does Vrolik mention it; but there was such a tendon very distinct in Duvernoy's Gorilla. The *Extensor proprius indicis* was as in man, but perhaps arose a little lower down on the ulna.

Palmaris longus and P. brevis. These are not constantly present in the Quadrumana; the former was in this Chimpanzee, as in Vrolik's, but it does not exist in the Gorilla according to Duvernoy, and Prof. Wyman does not mention it. It was wanting in one arm of Traill's Chimpanzee, but present in the other, and Mr. Moore found it in the right arm of Ateles Paniscus, while Mr. Folsom did not in the left. I did not see any *P. brevis*, but Vrolik says it existed in his specimen. It was present in the Gorilla of Duvernoy, but not in that of Prof. Wyman.

Flexor sublimis digitorum. This in the left arm was as in man, but in the right arm Mr. Moore is certain that the ring finger received two tendons, and the little finger none. The *Flexor profundus digitorum* is very thick and strong. As in Duvernoy's Gorilla, the portion supplying the index finger is separate from the rest, and joined with the long flexor of the thumb; the remainder occupies the place of the entire *Flexor communis* in man. (For the shortness of its tendons, see above.) The *Flexor proprius indicis et pollicis* arises from the radius, in the position of the *Flexor pollicis only* in man; it sends a strong tendon to the index finger; from the lower surface comes off a slender tendon

which is inserted into the base of the second phalanx of the thumb. The thumb has thus become merely an aid in the grasping of the fingers, with little or no independent action. A like arrangement existed in Duvernoy's Gorilla, but in Prof. Wyman's Gorilla, and in his and Traill's Chimpanzees, this muscle did not exist separate from the rest. Tyson says that the muscles of the thumb differed not from the human, but there was no tendon to the thumb in Vrolik's specimen. In the lower *Quadrumana*, when there is any tendon for the thumb it generally comes from the common flexor; there was none in *Ateles Paniscus*, whose thumb is rudimentary; in the Howling Monkey there were four tendons,—one to the thumb, but none to the little finger.

The short muscles of the thumb were all present, but thinner and less distinct than in man; they exist in the Gorilla and Howling-Monkey, but not in *Ateles Paniscus*, except perhaps a very little rudiment. The *Extensor longus pollicis (secundi internodii)* is present generally in the *Quadrumana*. The *Extensor brevis pollicis (primi internodii)* was quite as large as the preceding, not smaller as in man, and was inserted into the radial side of the base of the metacarpal of the thumb, as in the specimens of Wyman and Vrolik; Tyson says the insertion was as in man. In the Gorilla, Prof. Wyman does not mention any peculiarity; and Duvernoy says it is as in man, but that it is wanting in the Chimpanzee, the *Abductor longus* taking its place; in this Chimpanzee it was confounded with the latter only above. It was wanting in the Howling-Monkey, and in Prof. Wyman's *Cynocephalus* was joined to the *Abductor*, which goes to the trapezium. The *Abductor longus pollicis (Extensor ossis metacarpi)* was inserted into the trapezium, as in the specimens of Prof. Wyman and Vrolik, and in Prof. W.'s *Cynocephalus*, but in the Howling-Monkey it is as in man. In the left arm of *Ateles Paniscus* Mr. Folsom says it was present, but Mr. Moore

thinks that in the right arm it was united with the *Extensor brevis*, with a double tendon attached to both trapezium and metacarpal bone. See Duvernoy for his views as to the homologies of these three muscles.

All the muscles of the little finger were present, as also in the Gorilla. The *Lumbricales* were like the human, except that the slip supplying the little finger did not arise from the tendon of the deep flexor of that finger, but only from that of the ring finger. The *palmar Interossei* were much, and the *dorsal Interossei* little, developed.

I dissected the muscles of the back and of the abdomen only enough to see that the former, as extensors, were weaker than in man, while the latter were stronger, both as very important flexors of the trunk, and as supports to the viscera, in the creature's semi-erect position.

*Psoas parvus*. Absent on both sides of this individual. Not mentioned except by Tyson, who says it was larger than in man. Present in the Gorillas of Wyman and Duvernoy, in the Howling-Monkey, in Macaci, and Cynocephali.

*Quadratus lumborum*. Shorter than in man, as the *Psoæ* and *Illiacus* are longer. Mentioned only by Duvernoy as in the Gorilla, and by Wyman as in the Howling-Monkey, where it is more slender than in man, and arises from the transverse processes of the four upper lumbar vertebræ, and from the body of the first.

*Quadratus femoris*. Longer and narrower than in man, as noticed by Owen in the Orang, and naturally from the downward projection of the ischium.

I am quite sure that the other rotators were present, but at the time of the dissection I was not sufficiently familiar with their limits in man to compare them with much certainty.

*Pectineus* and three Adductors. These are present, but more intimately connected than in man. They form a



very large fleshy mass, and are inserted down the whole length of the femur, the principal portion of the *Adductor magnus* being attached by a strong tendon to the internal condyle. They would not only adduct the thigh strongly, as in climbing, keeping the inverted sole against the tree, but from the backward projection of the ischium, the *Adductor magnus* especially becomes a powerful extensor of the limb for leaping.

*Psoas magnus*. Arises from the four lumbar vertebræ, and perhaps from the thirteenth dorsal; some fibres also seem to come from the upper part of the ilio-pectineal line, which may represent the small, distinct muscle of the Orang, described by Prof. Owen as coming from the fore part of the ilium, and inserted at the root of the trochanter minor. The *Psoas* is blended with the *Iliacus* in the whole length of the latter, and both continue fleshy quite to the insertion.

*Iliacus*. See *Psoas magnus*.

*Scansorius*, (Traill). This muscle arises from the whole outer border of the ilium, nearly as far down as the acetabulum, and is inserted into the lower part of the great trochanter, between the origins of the *Vastus externus* and *Cruræus*. It would rotate the thigh a little inward from its usual position, but its use is most obvious as an extra flexor of the thigh; it is a rather thin, but fleshy and perfectly distinct, broad, triangular muscle, but so far as I can learn, it has been found only by Traill, who first discovered it in his Chimpanzee, and by Prof. Owen in his Orang. When its use is so apparent, it is strange that it should be so rare, and so variable in the same species.

*Rectus femoris anticus*. See *Quadriceps femoris*.

*Tensor vaginæ femoris*. This was larger than in man, and continuous with the upper thin portion of the *Glu-tæus maximus*. Like the *Rectus*, it would help to flex the thigh.



*Glutæus maximus.* Arises from the border of the lower half of the sacrum and coccyx, from the fascia covering the *G. medius*, from the great sacro-sciatic ligament, and from the tuberosity of the ischium in close connection with the long head of the *Biceps*. The upper part of the muscle is very thin, and chiefly joins the *Tensor vaginæ femoris*; but the lower portion, especially that from the ischium, is very thick and strong, and inserted upon the whole length of the femur from the base of the great trochanter to the outer condyle, at which point it thickens and widens, some of its fibres seeming to mingle with those of the *Vastus externus*. This ischial portion in the Gorilla is described by Duvernoy under the name of "*Ischio-femorien*." Acting alone, it would rotate the thigh outward, so as to allow the sole of the foot to be turned inward, after which it would assist the *Adductors* in keeping the foot close against the object grasped in climbing, but acting with the *Glutæus medius*, it would help to extend the thigh.

*Glutæus medius.* As in the *Quadrumana* generally, this is the largest of the three *Glutæi*, being long and thick from the length and posterior concavity of the ilium. It is attached to the tip of the great trochanter.

*Glutæus minimus.* A thin, flat, radiated muscle covering the posterior border of the acetabulum, and, I think, was attached to the great trochanter; I am not sure whether it arose at all from the coccyx.

I think there has always been some misapprehension as to the true functions and importance of the two great *Glutæi* as contrasted in man and the *Quadrumana*. In the latter they are generally described as small and weak; whence the inability of these animals to stand erect or upon one leg as we do. But, apart from the grave error of stating an effect for a cause, the real distinction seems to me to be not so much in the size as in the position

of these muscles. Man stands or walks erect with ease, and his *Glutæi* are very large; the ape with difficulty approximates to the erect position, and it is doubtful if he is at all able to stand on one leg, whence it seems to be inferred that his *Glutæi* must be very small and weak. But suppose we had first studied their actions in the ape; having seen that by means of them he leaps well, and knowing that man does not leap so well, the same reasoning would lead us to believe that the *Glutæi* of man cannot be very large. The truth is, that these same muscles perform two sets of movements in both man and the ape, but in the former they are so disposed, in conformity to the rest of his structure, as to be best adapted to assuming and maintaining the erect position, while in the latter their form and direction are so modified as to be more favorable to leaping. Many of the lower animals, the Horse for instance, have a very large *Glutæus medius*. Yet they never stand erect. It is the muscle with which they kick, and kicking differs from leaping only in the position of the fixed point of the action. I do not believe that the *size* alone of the *Glutæi* in the ape has any influence upon his natural attitude, but that if his body and legs were so balanced as to enable him to assume the erect position at all, the muscles as they are would have sufficient strength to maintain it, though no doubt with less steadiness than those of man. But the entire skeleton and many other points in the muscular system show conclusively that they never were designed to do any such thing; even with the great bulk of our extensors we find it extremely tiresome to stand or walk with the limbs and trunk semi-flexed, and that is the natural attitude of the ape, who is then principally supported by his long arms, the hands either resting on the earth or grasping some object. The pelvis of man is short and broad, the ischia being short and near together, allowing the limbs to swing freely by them. The *Glutæus maximus* lies about equally above and be-

low the socket or centre of motion. But in the *Quadrumanus*, and in most of the lower animals, the ischia are lengthened and spread out, since the legs do not swing behind them; the *Glutæi maximi* arise chiefly from the tuberosities, and are inserted generally much lower on the femur than in man, their increased length enabling them to contract through a longer space, and they are thus powerful retractors of the whole limb to a certain extent, though not so as to bring it into line with the trunk, however strong they may be. In man the external surface of the short, broad ilium looks outward like the acetabulum, and the fibres of the *Glutæus medius* converge from their broad origin to the great trochanter; the entire arrangement being such that the muscle acts to prevent the body from sinking to one side when supported by the opposite leg, and also, from the great breadth of its origin to assist the *Glutæus maximus* and *Psoas* in preserving the balance forward and backward, which also is required in ordinary progression. But in the ape the external surface of the ilium looks upward or backward, while the acetabulum still looks outward as in man, thus at right angles with that surface; the ilia are long and narrow, so that the fibres of the *Glutæus medius* run nearly parallel to each other, and the muscle is inserted at the end, not, as in man, down the outer side of the trochanter, upon which in the flexed state of the femur the muscle acts as upon the short arm of a lever of which the leg is the long arm; just as in man when the femur is flexed, though to more advantage, on account of its attachment to the tip of the trochanter. It also tends to rotate the limb inward, which, when simple extension is required, is counteracted by the simultaneous contraction of the *Glutæus maximus*, which rotates in the opposite direction. It appears, then, that the peculiar attitude of the ape is not connected with the size alone of the *Glutæi*, but that since he was not de-



signed to stand or walk erect, or to rest on one leg, his entire frame is constructed not for those, but for another set of movements which are subsidiary in man, but to the performance of which both skeleton and muscles in the ape are perfectly adapted.

*Quadriceps extensor femoris.* The *Rectus* has but a single tendon, from the inferior spinous process of the ilium, the tendon from the acetabulum being absent, as in *Ateles Paniscus* and in a *Macacus*; this peculiarity is not elsewhere mentioned. The *Rectus* may act as a powerful flexor of the thigh, in which case its extensor power is easily counteracted by the flexors of the leg, which are inserted so low down as to act at even more advantage than in man. Both this muscle and the scapular head of the *Triceps humeri*, of which it is the homotype, are obviously of more use to the ape as flexors than as extensors.

To lessen the jar on striking the earth, and for the more advantageous attachment of muscles, the limbs of most animals, especially those which move quickly, are constantly flexed in two or three places; to support the weight of the body without still greater flexion, the extensors are very thick and strong; in the elephant, however, whose enormous bulk would require supports of perhaps unmanageable size, the limbs are straight as in man; but the legs of the ape are constantly bent, and yet his extensors are not even so strong as in man, showing that the greater portion of his weight must be supported by the arms in front.

The employment of the ape's foot as an organ of prehension requires an extent and freedom of motion at the knee far beyond that exercised by man; the movements must also be more prompt and easily executed; this is provided for by the low insertion of the flexors on the tibia, and by the length of the fleshy portion of the muscles, depriving the *Semi-Membranosus* and *Semi-Tendinosus* of



the characters which gave them their names in Human Anatomy. The reverse is the case in the leg of the common Quadruped, the Dog or the Cat; in them the movements are simply forward and back, quick and forcible, but limited; the muscles therefore are very thick and strong, but short, and the limbs are sharply bent at the joints. But this mass of muscle about the limb would be wholly inconsistent with the motions of the prehensile foot of the ape, or even a baboon, in whom therefore the muscles are comparatively long and slender. The limbs of the Quadrumana are also projected further from the trunk than in the lower animals. In man the leg can be rotated at the knee only in a state of semi-flexion; this is the constant attitude of the ape's leg, and the rotation is very free. The short head of the *Biceps* would act as an external rotator in the Anthropoids, but in the Mandrill I do not think it exists, and in Quadrupeds generally it is wanting as such, though there is sometimes a slender slip from the pelvis.

*Sartorius*. Very long, from the great height of the ilium; it is inserted by a very short, fascia-like tendon on the front of the tibia, at least one third from the knee, over the *Gracilis*. The *Gracilis* is proportionally much thicker and stronger than in man.

*Semi-membranosus*. Tendon of origin long, that of insertion shorter, but attached as in man. The tendon of the *Semi-tendinosus* joins that of the *Gracilis*, and is inserted beneath it. *Biceps*. The long or ischiatic head is proportionally smaller than in man, and absolutely smaller than the *Gracilis* and *Semi-tendinosus*. The short head arises as in man, and joins the other at the knee, forming a very strong fascia which extends over the fibula nearly to the ankle, the tendon of the long head sending a strong prolongation to the outer tuberosity, as in man. The two heads were inserted thus together in the Chimpanzees of

Traill and Vrolik, but separately in the Gorillas of Wyman and Duvernoy, and in Owen's Orang. When on all-fours, these last three muscles would also help retract the leg; in a *Cynocephalus* the *Biceps* was also attached above the joint to the patella, and in the Dog, where the motion is simple retraction of the whole limb, the *Semi-membranosus* also is inserted into the patella, thus giving a broader attachment, when the separate flexion of the limb below the joint is not required. Like the *Glutæi*, these three muscles also serve to support the trunk on the legs in one direction, while the *Gracilis* and *Sartorius* antagonize them in front; their great size causes me to think, as in the case of the *Glutæi*, that if the trunk could be balanced they would be able to maintain it erect, though probably with not so much steadiness, on account of the heaviest part of the body being so far above the pelvis, and not in and about it as in man. The *Popliteus* is not constant; in this individual I think it was rather thicker than in man, but I did not find the cartilaginous nodule in the external lateral ligament where the muscle arises. Traill and Tyson could not find the muscle, but it was present in Vrolik's Chimpanzee, and in the Gorillas of Wyman and Duvernoy. Its action as a rotator inward would be balanced by the short head of the *Biceps*, which rotates outward.

Gastrocnemius and Soleus. These are much thinner than in man, but continue fleshy to their insertion; the latter has but one, the external head, as is generally the case in the *Quadrupana*. The two unite at about two thirds way down from the origins; the place of this union varies in different species, and often considerably in individuals of the same species; I do not see that the place of union, or the absence of the internal head of the *Soleus*, would have much effect upon the motions of the foot.

Plantaris. This was absent on the left side, and very

small on the right side of this Chimpanzee ; it was present in those of Vrolik and Tyson, but absent in that of Traill, in the Gorillas of Wyman and Duvernoy, and in the latter's Orang, in the Howling-Monkey and *Ateles Paniscus*. Not constant in the *Cynocephali*.

In man the *Glutæi* and long flexors of the leg have two sets of functions according as they take their fixed point from above or from below, that is, as they are used either for moving the legs by themselves as mere appendages, or for acting powerfully upon the trunk as in locomotion, and maintaining the erect position on one or both legs. In the ape, these positions not being required, the muscles are employed in locomotion and in leaping as we have seen above, but chiefly for moving the prehensile limb with any object which may be in its grasp ; they are therefore modified not so much in size as in position, in which latter respect we remark the evidence as to the intended semi-erect attitude of these animals. With the *Gastrocnemius* and *Soleus* the case is otherwise. They also perform two different functions according as they act from above or from below ; but in man their great strength is almost wholly employed after the latter manner, for raising and balancing the body upon the foot, while the movements of the foot on the leg are limited, and require little power. The body of the ape is not designed to be balanced upon the foot in his usual attitude, and in walking he lifts the foot as a part of the leg without much motion at the ankle. So in the ape the *Gastrocnemius* and *Soleus* are much more slender than in man, but their muscular portion is longer, in adaptation to the less powerful but more extensive and free movements of the prehensile foot. In most Quadrupeds, again, which rest on the ends of the toes or metatarsal bones, these muscles must be powerful like the extensors of the other segments of the limb. Thus we see that the semi-erect attitude of the ape



is indicated by the modification as to *position* of the *Glutæi* and long flexors of the leg, but by a difference in *size* of the extensor muscles of the foot.

*Tibialis anticus.* This muscle is thicker than in man, and continues fleshy lower down. In the *Quadrumana* generally, the division at the insertion, of the tendon into two parts is continued up so as to make two muscles more or less distinct. In the Gorilla of Duvernoy this division existed only a little above the ankle, but in this Chimpanzee the two parts were distinct above the middle of the leg, and the posterior or internal portion which is attached to the internal cuneiform bone was three times as large as the other. In Vrolik's specimen this portion arose upon the fibula. The anterior portion which goes to the metatarsal bone is called by Prof. Wyman "*Tibialis anticus minor*," and by Meckel "*Abductor longus proprius pollicis pedis*." The division evidently accords with the use of the great toe as a thumb.

*Peroneus longus* and *Peroneus brevis.* These are not so distinct as in man. The former would act as a flexor of the great toe, which enjoys considerable motion at the tarso-metatarsal articulation; there was a sesamoid bone in its tendon as in man. From the external border of the tendon of the *P. brevis* near its insertion a slender but strong fascia ran along the border of the metatarsal bone, and was connected above the knuckle with what seemed to be a remnant of the extensor fascia of the little toe.

*Extensor longus digitorum.* Origin and insertion as in man. In Tyson's Chimpanzee there was no tendon to the little toe, and in Owen's Orang none to the second toe. I find that at the time of my dissection I made no note of the ligament described by Vrolik, through which run the tendons of the *Extensor longus digitorum*, and now I have no recollection of it, though I presume it was present; and Mr. Moore says the muscle on the right side



passed through a separate loop just in front of the astragalus. In a small *Macacus* now before me, the real annular ligament is attached to the fibula higher than to the tibia, and not at all to the calcaneum; and there is also a perfect loop for the *Extensor digitorum*, of which both ends are attached close together on the upper border of the calcaneum. This loop is one third of an inch long, and freely movable after the fascia has been taken away. I should think that the position of the annular ligament wholly above the joint, and of this extra loop wholly below, would better enable the muscle to act, not only as an extensor of the toes, but also more freely as a flexor of the foot, when also the insertion of the loop on the outer edge of the calcaneum would perhaps supply the place of the *Peroneus tertius*:

*Peroneus tertius*. So far as I know, this has been found in the *Quadrupana* only once, in the Howling-Monkey by Prof. Wyman, where, however, instead of being a flexor of the foot, it passed beneath the outer malleolus, and was inserted into the base of the little toe, which it would serve to extend.

*Extensor proprius pollicis*. Probably present, though I neglected to make a note of it; on the right side as in man.

*Tibialis posticus*. Origin and insertion apparently as in man, but I saw no sesamoid bone near the insertion. In Owen's Orang it was inserted into the internal cuneiform, and in *Ateles Paniscus* into the scaphoid bone only. It is usually more slender than in man.

*Flexor longus digitorum*. Arises as in man, but continues fleshy to the ankle, below which it divides into two tendons, which are inserted into the distal phalanges of the second and fifth toes. The *Musculus accessorius* is inserted into the external border of this muscle, and from the tendon arise the three fasciculi of the *Lumbricales*

*Flexoris longi digitorum.* The disposition of the tendons of this muscle, and of the *Flexor longus pollicis*, is various in different individuals and species.

*Flexor longus pollicis.* This is a large, strong muscle arising as in man and continuing fleshy to the joint, where it forms a broad tendon which divides into three, which are inserted into the distal phalanges of the first, third, and fourth toes, as in the Chimpanzees of Vrolik and Traill, and in Duvernoy's Gorilla; the tendon of the first toe passes through a separate strong loop at the base of the metatarsal bone. In Owen's Orang the great toe received no tendon from either of the long flexors, but in the Howling-Monkey the great toe received the single tendon of the *Flexor longus pollicis*. In dissecting the *Ateles Paniscus*, both Mr. Folsom and myself at first described this muscle as the *Flexor longus digitorum*, being deceived by its great size, and the number of its tendons. The tendons of the two muscles before their subdivision are firmly connected by a whitish substance. As in Owen's Orang, bending the foot up against the leg caused a mechanical flexion of the toes which would materially increase the firmness of the foothold upon a branch.

*Flexor brevis digitorum.* Arises as in man, but has only two tendons, which are inserted into the middle phalanges of the second and third toes.

*Flexor accessorius.* Has but one, the external head, which is joined to the outer border of the *Flexor longus digitorum*. Both this and the *Flexor brevis* vary considerably in different species, and also in different Chimpanzees.

*Lumbricales Flexoris longi digitorum.* Three fasciculi arising upon the tendon of the *Flexor longus digitorum*; the inner one is attached to the inner border of the first phalanx of the second toe, the middle one joins the tendon of the *Flexor brevis*, to be inserted into the second phalanx of the third toe after being perforated by the tendon

of the *Flexor longus pollicis*, and the third or outer fasciculus is also perforated by a tendon of the same muscle, and is then attached to the second phalanx of the fourth toe.

*Lumbricales Flexoris longi pollicis*. Also three fasciculi arising between and on both sides of the two tendons of the *Flexor longus pollicis*, and inserted into the inner borders of the bases of the first phalanges of the third, fourth, and fifth toes. Thus each toe receives a tendon from a long flexor to its third phalanx, the four outer toes each a *Lumbricalis* to the base of the first phalanx, the second, third, and fourth each a tendon from a short flexor to the second phalanx, and that of the third toe is also joined by a tendon from a long flexor; the first and fifth toes having peculiar short muscles of their own, receive fewest tendons from the common flexors, and of the other three the middle one is naturally best provided. (See Table.)

On the following Table, the asterisks indicate the insertion of tendons of the muscles named at the left, into the base of those phalanges of those digits against which they respectively stand; thus exhibiting the distribution of the tendons of each muscle, the tendons which each digit receives, or the tendons which are inserted into any one phalanx.

MUSCLE.		MAN.					TROGLODYTES NIGER.					
		1st digit.	2d digit.	3d digit.		5th digit.	1st digit.	2d digit.	3d digit.	4th digit.	5th digit.	Phalanges.
Long flexors.	Flexor longus digitorum		*p'g <sup>1</sup>	*p'g	*p'g	*p'g		*p'g			*	3d 2d 1st
	Flexor longus pollicis	*					*		*p'g	*p'g		3d 2d 1st
	Flexor brevis digitorum		*p'd <sup>2</sup>	*p' <sup>1</sup>	*p'd	*p'd		*p'd	*p'd <sup>3</sup>			3d 2d 1st
	Lumbricales Flexoris longi digitorum		*	*	*	*		*	*p'd	*p'd		3d 2d 1st
	Lumbricales Flexoris longi pollicis								*	*	*	3d 2d 1st

<sup>1</sup> P'g=perforating.

<sup>2</sup> P'd=perforated.

<sup>3</sup> This tendon joins that of the *Lumbricales Flexoris longi digitorum*, and is inserted with it.



From the above Table it will be at once remarked, that in the human foot there are three muscles distributed uniformly to the corresponding phalanges of the four lesser digits, which latter also are of nearly equal power and importance; while in the foot of the ape, this uniformity does not exist, and the digits are more independent of each other, the middle one being the strongest, as in the hand of man, in adaptation to the prehensile function of the member.

The *Interossei* on the dorsal and plantar surfaces were not very distinct from each other, but the latter far exceeded the former in size.

*Extensor brevis digitorum.* In the *Quadrumana* this consists of only three fasciculi, supplying the second, third, and fourth toes as in man, the fasciculus supplying the first or great toe being so distinct from the rest as generally to be considered a separate muscle; this is apt to cause confusion in comparing dissections by different authors; Traill says the *Extensor brevis digitorum* sent tendons to all the toes, but Tyson says it was wanting altogether. (?)

*Extensor brevis pollicis.* Forms a distinct muscle in most of the *Quadrumana*; it is inserted as in man, but has a more oblique direction on account of the angle which the great toe forms with the side of the foot.

*Flexor brevis pollicis.* Consists of two fasciculi as in man, the tendon of the *Flexor longus* running between them. I did not note the origin of the internal head which is inserted with the *Abductor pollicis*, but the external or deep-seated portion appeared to come from the internal cuneiform and partly from the metatarsal bone, and the two heads were rather more distinct than in man. Vrolik describes but one fasciculus, but generally there are two. In Owen's Orang, the channel usually filled by the tendon of the long flexor was occupied by a small, short flexor arising upon the metatarsal bone, and inserted into the first phalanx.



**Abductor pollicis.** A strong muscle, arising, so far as I could see, upon the calcaneum alone, and inserted as in man with the internal head of the *Flexor brevis*, which indeed is far more closely connected with it than with the external head. From the small size and more outward position of the calcaneum, and the divergence of the great toe, this muscle would act rather as a direct *flexor* and *adductor* than as an *abductor*. Vrolik says there was a smaller fasciculus from the internal cuneiform, which perhaps represented the internal head of the *Flexor brevis*, of which he says there was but a single head. In the Howling-Monkey the Abductor consisted of two parts, the one from the calcaneum being the more distinct, and acting as a flexor.

**Adductor pollicis obliquus.** Corresponds to the single muscle in man, but is very much larger and more nearly transverse; it arises as in man, and is inserted into the first phalanx of the great toe, as in Vrolik's Chimpanzee and in Duvernoy's Gorilla and Orang. Traill makes no division into two, but seems to include both this and the *Adductor transversus* as one large muscle extending nearly the whole length of the second metatarsal. The *Adductor pollicis transversus* appears to arise from the heads of the second, third, and fourth metatarsals, and is thinner than the preceding; it is attached to all the bones of the great toe from the head of the metatarsal inclusive, as in Duvernoy's Gorilla and Orang. Vrolik says it came from the fifth metatarsal. The *Transversalis pedis* is either unmentioned or declared absent by all the authors, excepting perhaps Duvernoy. There is none in this Chimpanzee, unless the *Adductor transversus* represents it, as it certainly does pretty nearly in position and action.

**Flexor brevis minimi digiti.** Has its origin and insertion as in man. The *Abductor minimi digiti* arises as in man, but seems to consist of two not very distinct por-

tions, of which the internal is long and fleshy, and inserted into the base of the second phalanx as in the right foot, and as in Vrolik's specimen; while the external is small, and attached to the base of the fifth metatarsal. Neither Traill nor Tyson mention this peculiarity.

Perhaps I can add nothing to what has been said by others, of the great contrast in function, and thence in structure, between the extremities of man and the ape. In the latter the hand is chiefly an organ of suspension, composed of four strong, flexible hooks, which, even when the member is employed as a hand, are flexed all together, the short, feeble thumb, so nearly in the same plane with them, not being opposable to the individual fingers. The foot is the organ of prehension, being broad, the great toe standing out as an efficient thumb, with large and distinct muscles; and even when used simply for supporting the body on a branch, the whole foot forms a flexible tripod far more serviceable than the stiff narrow foot of man.

#### WORKS EMPLOYED FOR COMPARISON.

1. Duvernoy, Prof. *Des Caractères Anatomiques des Grands Singes Pseudo-Anthropomorphes. Deuxième Mémoire. Archives du Muséum. Tome VIII. In Lib. of Harv. Univ.* (A very complete anatomy of the Gorilla.)

2. Edes, Robert T. *Dissection of a female baboon. (Papio Maimon.) MS. notes.*

3. Moore, Joseph. *Dissection of the right side of the Chimpanzee, of which the left side was dissected by Burt G. Wilder. MS. notes.*

4. Owen, Prof. R. *Myology of Simia Satyrus. Proceedings of Zoölogical Society of London. Jan. 25th and May 10th, 1831. Lib. Harv. Univ.*

5. Traill, Dr. T. S. *Observations on the Anatomy of the Orang-outang, (Chimpanzee.) Memoirs of the Wernerian Nat. Hist. Society. Vol. 3, Feb. 7th, 1818. Lib. of B. S. N. H.*

6. Tyson, Dr. Edward. Anatomy of a Pigmy. Lib. Harv. Univ.

7. Vrolik, Prof. W. Recherches D'Anatomie Comparée sur le Chimpanzé. Lib. B. S. N. H.

8. Vrolik, Prof. W. Article "Quadrumana." Todd's Cyclopædia of Anatomy and Physiology. Lib. of B. S. N. H.

9. White, Dr. J. C. Dissection of a Mandrill. MS. notes.

10. Wilder, Burt G. Muscles of a young male Chimpanzee; left side. MS. notes.

11. — Muscles of the fore-legs of a female Angora Goat. Hind-legs of same, by Joseph Moore. MS. notes.

12. Wyman, Prof. J. MS. notes. Muscles of a young Gorilla.

13. — Muscles of a Cynocephalus, (arm.)

14. — Muscles of a Howling-Monkey.

15. — Muscles of a young Chimpanzee. Proceedings of Bost. Soc. Nat. Hist. Vol. 5, Nov. 21st, 1855. Lib. of B. S. N. H.

16. MS. notes more or less complete on two Cynocephali, three Macaci, and an Ateles Paniscus, dissected by Norton Folsom, J. S. Lombard, Joseph Moore, William Nichols, Jr., and Burt G. Wilder. 1861.

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[Since writing the foregoing paper, I have made a careful examination of a living Chimpanzee, of which some account is given in the Proceedings of the Boston Society of Natural History, June 18, 1862.

The most important result of the examination was the correction of the inference contained on pages 364 and 365 of this paper, and which was naturally made from the specimen I dissected. But in the live animal the hand



and fingers *can* be bent back together quite as far as those of man; so that the error was occasioned by the unnatural contraction of the flexor muscles, which are very thick and fleshy, by the spirit in which the animal had been preserved. And it will be seen that this structure, as found in the dead specimen, while most completely adapted for climbing, would have almost entirely precluded the use of the hand for any other purpose.

BURT G. WILDER.]

Cambridge, July, 1862.

ART. VII.—*On Alternate Generation in Annelids, and the Embryology of Autolytus cornutus.* By A. AGASSIZ.

O. F. Müller, in his *Zoölogia Danica*, figures a small worm (*Nereis prolifera*), in the act of reproducing itself by division. For many years this mode of reproduction among the higher Annelids remained unconfirmed, and many authors, Ehrenberg especially, began to throw doubts upon the observation of Müller. He even went so far as to establish a division among worms, founded entirely upon the mode of reproduction by division such as had been observed among *Naidina* (called by him *Somatotoma*), in opposition to the others in which this mode of reproduction does not obtain, and to which *Nereis prolifera* belongs. It was not until Quatrefages and Milne Edwards had both observed a similar phenomenon in two other genera (*Syllis* and *Myrianida*), that Müller's observation was placed beyond the question of a doubt; and when the same mode of development was observed by Sars in *Filograna*, and after his observations had been repeated a few years later by Schmidt in a second species of that



same genus, it was evident that this mode of reproduction was not confined to the *Naidina*, and that we might expect to find it in other families of Annelids as well as in the two in which it had been observed. The peculiar phenomena preceding the separation of the sexual individuals, the fact that the eggs and spermatozoa seemed to be developed only in the part which was to form a new individual, soon suggested the idea that we might have here a phenomenon, similar to that of alternate generation, taking place among the Annelids.

Müller\* had observed that the individuals about to separate were alone filled with eggs, and that these eggs were less advanced in those sexual individuals which were farther from the posterior extremity. He also says, that he found as many as three proliferous individuals placed like links in a chain, one behind the other, the smallest (the youngest) being placed nearest the anterior extremity. Quatrefages† found on the coast of Bretagne a species of *Syllis* which reproduced itself by division, producing, however, only a single individual, either a male or a female, and he observed that the anterior part never showed the slightest trace of either male or female organs. This led him to suppose that the individuals which became detached were alone capable of sexual reproduction. It is not until several years afterwards, when he returns to the same subject‡, and publishes more in detail his observations, that he comes to the conclusion that these phenomena of reproduction by division may be satisfactorily explained as cases of alternate generation. According to his ob-

\* Müller (O. F.) *Zoölogia Danica* II., Pl. 52, fig. 5-9, p. 15. Havniæ, 1788. Copied Ency. Method. (Vers. Vol. I., Pl. 56, fig. 12-15.)

† H. Milne Edwards, *Rapports sur une série de Mémoires de M. A. de Quatrefages, relatifs à l'organisation des animaux sans vertébrés*. *Comptes Rendus*, 15 Janv. 1844. *Ann. des Scien. Nat.* 1844, I., p. 22.

‡ A. de Quatrefages, *Mémoire sur la génération alternante des Syllis*. *Ann. des Sc. Nat.* 1854, II., p. 142, Pl. IV., fig. 3-15.

servations, striking differences between the young males or females and the parent stock [le parent, l'individu primitif, la souche] are developed after their separation. He says nothing of the development of the eggs of these individuals [l'individu adventif, la nourrice,\* la fille] into the parent stock, and simply states the fact of the alternate generation, without having actually observed it. Milne Edwards† observed a case more similar to that which Müller had seen. He found in *Myrianida* five or six young already quite well developed, the more advanced being nearer the tail: he did not observe the mode of development; but by carefully comparing the less with the more advanced, he shows how closely this mode of development of the different parts corresponds to the development of the same parts of an embryo from an egg. He also observed that the proliferous individuals were provided with sexual organs, and that they seemed alone capable of reproducing the species from eggs. Sars‡ observed the same phenomenon in the *Serpulacea*, in *Filograna implexa*, and shows on what slight grounds Ehrenberg§ had based

\* Quatrefages has applied the word *nurse* (nourrice), as generally used, to denote the individual from which the sexual individuals are developed, in a manner very different from that of Steenstrup. He seems to have misunderstood the application of the "Amme" of the Germans, and has applied his term "nourrice" to a different stage. He has given to the individuals which the Germans call "Amme," the name of "parent," and has given the name of "nourrice" to the males and females developed from this "parent." This is certainly not the meaning of Steenstrup, and of the German writers on alternate generation. For according to this nomenclature of "Quatrefages," we should call "*parent*" the Strobila, Cercaria, and call "*nourrice*" (Amme) Aurelia, Distoma, instead of calling the former (Strobila and Cercaria) the nurses, as is done by Steenstrup. The name of "parent," also, for the "Amme," is objectionable, as it is contrary to the usual meaning of the word; and the application of the word "nourrice" to males and females is certainly not in accordance with our understanding of the meaning of that word. What I have called the "*parent stock*" corresponds to the "Amme" of Steenstrup. I have given to the offspring the name of sexual individuals, or of "males" and "females" simply.

† Milne Edwards (H.) Ann. d. Sc. Nat., 1844, III., p. 170.

‡ Sars (M.) Fauna litoralis Norvegiæ, p. 86. Christiana, 1846.

§ Ehrenberg (C. G.) Die Akalephen des rothen Meeres, p. 82. Berlin, 1836.

his class of *Somatotoma*. These observations of Sars were soon after repeated in a second species of the same genus, *Filograna Schleideni*, by Schmidt; and his observations plainly show that a part of the parent stock passes into the sexual individuals when the division takes place. Only one individual is formed at a time in this species. Frey and Leuckart\* repeated the observations of Müller in "*Nereis prolifera*" to a certain extent: they found several of the young in a slightly advanced state of development; but as their observations were intended to show that the development of *Nereis prolifera* was a case of budding and not one of division, that there was nothing in the development to justify the assertion of an alternate generation made by Quatrefages, and as their conclusions were based upon these slightly developed males and females, it is not astonishing that we find them assert that there is not the slightest difference between the young and the parent stock, and that they never found spermatozoa developed in the former. It was not until Krohn† was fortunate enough to observe the whole development of *Nereis (Autolytus) prolifera*, that it became evident that the remarkable phenomena which he observed connected with the differences developed in the male and female young could only be explained on the supposition of an alternate generation. He dwells particularly on the striking difference between the males and females, and is led to believe that Müller‡ must have observed the male of his *Nereis prolifera*, and described it as a different species, (*Nereis corniculata*,) on account of the great differences of the anterior part. He says, the only link now want-

\* Frey (Dr. H.) und Leuckart (Dr. R.) Beiträge zur Kenntniss Wirbelloser Thiere, mit besonderer Berücksichtigung der Fauna des Norddeutschen Meeres. Braunschweig, 1847.

† Krohn (Dr. A.) Ueber die Erscheinungen bei der Fortpflanzung von *Syllis prolifera* und *Autolytus prolifera*. Wiegman. Archiv 1852, I., p. 66, Pl. III., fig. 1.

‡ Zool. Dan., Pl. 52, fig. 1-4, p. 15.



ing, is to trace the development of an embryo coming from the egg of one of the female individuals into a parent stock similar to that from which the sexual individual was produced, and which should in its turn produce males or females only by division, and not by sexual reproduction.

It is this link which I have been able to supply, having had the good fortune to observe in a species of *Autolytus* of our coast the development of male and female individuals, differing to a degree almost unknown in the class of Annelids,\* from parent stocks different from both of these prolific individuals. I have also succeeded in tracing from the eggs the growth of the young embryo into a parent stock, identical in every respect with the parent stocks from which the males and females were produced by division. There can no longer be any doubt that we have in the higher Annelids an alternate generation. It seems to me highly probable that further investigations will show this to be the case for other genera, such as *Psammathe*, *Heteronereis*, *Exogone*, *Cystonereis*, and all those Annelids in which we find a specialization of a certain number of rings, as is the case in the sexual individuals of *Autolytus*. Whether alternate generation will explain the phenomena of unsexual reproduction of *Nais*, cannot be settled without further investigations; as the contradictory statements of the different authors leave it very doubtful whether there is anything like a parent stock existing in *Naidina*.†

\* Oersted (Mag.) had observed in *Exogone naidina* great differences between the two sexes, but they were not as striking as in *Autolytus*. As this genus is closely allied to *Autolytus* we may look for phenomena similar to those observed in that genus.

Oersted (Mag.), Ueber die Entwicklung der Jungen bei einer Annelide, etc. Wieg. Archiv, 1845, I., p. 20. See also Kölliker on the development of *Cystonereis*, Nouv. Mém. de la Soc. Helvet. des Sc. Nat. VIII., 1847.

† Schultze (Dr. Max Sigm.), Ueber die Fortpflanzung durch Theilung bei *Nais proboscidea*. Wieg. Archiv, 1849, I., p. 293. Leuckart (Dr. R.), Ueber die ungeschlechtliche Vermehrung bei *Nais proboscidea*. Wieg. Archiv, 1851, I., p. 134.



Species allied to *Nereis prolifera*, owing to this remarkable difference between the males, females, and parent stock, have been placed in no less than four different genera. Örsted \* is the first who has given a good description of the male of an *Autolytus*, under the name of *Polybostrichus longosetosus*. Unfortunately, this name cannot stand, as it had been applied before by Brandt, in 1838, to a genus of *Acalephs*, and must give way to *Autolytus* which was given by Grube † to the parent stock. From the figure of O. F. Müller he established a new genus for the male under the name of *Diploceræa corniculata*.‡ Johnston § had given a very good description of the parent stock in the 15th vol. of the "Annals and Magazine." Finally, the female was first seen separated from the parent stock by Johannes Müller; || and he made still another genus, *Sacconereis*, for a small worm which he observed in Trieste, belonging to the same cycle. There is also an account of two remarkable worms found by Max Müller ¶ in Helgoland, and which I am inclined to think are the free young (♂ and ♀) of the *Nereis prolifera* of Müller. This is the more probable, as the observations of Frey and Leuckart were made at the same place, and is confirmed also by the descriptions given by Krohn, apparently agreeing closely with the drawings given by Müller (M.), as well as by what I have observed in our own species (*Autolytus cornutus*), where we have males and females differing only slightly from the *Sacconereis* of M. Müller;—we find still less difference when we compare the figures of the

\* Örsted (A. S.), Grönlands Annulata Dorsibranchiata, p. 30, Pl. V., fig. 62. Kjöbenhavn, 1843.

† Grube. Die Familien der Anneliden, Wieg. Archiv, 1850, I., p. 310.

‡ Grube. Die Familien der Anneliden, Wieg. Archiv, 1850, I., p. 312.

§ Johnston (Geo.), Syllis prolifera, Ann. and Mag., XV., p. 146, pl. IX., fig. 4.

|| Müller (Joh.), Ueber den Allgemeinen Plan in der Entwicklung der Echinodermen, p. 7. Berlin, 1853.

¶ Müller (Max), Müll. Archiv, 1855, p. 13.

parent stock given below (Pl. X., fig. 1,) with that given by Johnston, of (*Syllis prolifera*) the parent stock of the European species.

The synonymy of this genus will therefore be as follows:

AUTOLYTUS.

*Autolytus* (*Grube*), Wieg. Archiv. 1850, I., p. 310 (parent stock).

*Polybostrichus* (*Örsted*, A. S.), Grönlands Ann. Dor-sib. 1843, q. a., (♂) (preoccupied).

*Diploceræa* (*Grube*), q. a., (♂).

*Sacconereis* (*J. Müller*), q. a., 1853, (♀).

“ (*M. Müller*), q. a., 1855, (♀ and ♂).

*Syllis* (*Johnston*, *Geo.*), q. a., 1845 (parent stock).

From what precedes it is seen, that there are known at present three species of *Autolytus* besides that found on our coast, and for which I have proposed the name of *Autolytus cornutus*. They are *Polybostrichus longosetosus*, from the coast of Greenland; *Sacconereis Schultzii*, from Trieste, and *Sacconereis Helgolandica*. There are good figures of two of these species; so that I have satisfied myself that the species found on our coast cannot be identical either with the species of Greenland or with that of the German Ocean. As Max Müller had ample opportunity of satisfying himself of the identity or difference of the species from Helgoland and that of Trieste, there can be no doubt of their specific difference.

*Autolytus cornutus* resembles more in its general appearance the *S. Helgolandica* than the Greenland species. It has a smaller number of rings than *P. longosetosus*; the tentacles of the head are shorter. (The figure of Örsted being that of a male, the comparison made here applies only to the male.) The cirri of the anterior and posterior rings are more equal in length, while in *longosetosus* the

cirri of the rings with long setæ are exceedingly short when compared with those of the anterior rings. It differs from *S. Helgolandica* in having a larger number of rings; the rings without the long setæ are more numerous in both the sexes than in *Helgolandica*. In the latter the female has two, and the male three rings, having only stiff bristles, while in the *cornutus* the female has six, and the male five rings, in which the long setæ are wanting. The number of rings of *Autolytus cornutus* in the full-grown males and females is different: usually from twenty-seven to thirty in the former, and from thirty-five to forty or even fifty in the latter. *Sacconereis Helgolandica* has fewer rings, and *P. longosetosus* a greater number than the species found on our coast.

The most striking characteristic of the genus *Autolytus* is the remarkable difference between the sexes. Had I not observed the development of these males and females, so widely different, coming from parent stocks\* (from which they are produced by transverse division, as I shall show hereafter), developed from eggs laid by the same individual, I could scarcely have credited their generic identity. (See Pl. IX., fig. 1, and Pl. XI. fig. 8.) It is therefore perfectly natural that Johannes Müller should not recognize in a female *Autolytus* the genus *Polybostrichus*, which was characterized by Örsted from a male. At the time when Max Müller discovered his *Sacconereis Helgolandica*, he used to find also in great numbers a small worm (invariably a male), which he says had the general appearance of *Sacconereis*, but differed in such a remarkable manner, that it seemed to him impossible that there should be such an exceptional case of difference between the males and females, entirely unprecedented in the class of Worms. It was only after tracing the complete development by "transverse division" of males and females, differing in

\* See below for description of parent stock, p. 397.



such a remarkable manner, from parent stocks in which I could not perceive the slightest difference, that I satisfied myself that these individuals, which seemed to have so little in common, were only the two sexes of one species. I have before me the drawings of a male and female of this genus (*Polybostrichus longosetosus*, Örst.) made under the direction of my father in 1849, which are referred by him to two different genera.\*

The female *Autolytus cornutus* (Pl. IX., fig. 1), is a small worm about one half an inch in length, of a flesh color, the alimentary canal appearing as a green tube extending from one end to the other; the posterior and the anterior rings are of a greenish tinge. The cirri are also flesh-color, and the eyes a dark chestnut-brown. The head has three long tentacles, the longest (*a*) placed directly in front on the middle of the head, and one tentacle, (*a'* *a''*), nearly as long as the central one, placed on the dorsal side directly in advance of the eyes, which are placed on each side of the head. The eye consists of two lenses of unequal size. This compound eye (*b*) is placed in an oblique position, so that the larger eye is nearer the ventral side and in advance of the smaller eye, which is placed nearer the back, but farther from the anterior part. Directly behind the eyes, on the ventral side, we find a tentacular cirrus (*c*) about one third the length of the tentacle (*a''*); this cirrus is slender and placed on an exceedingly narrow ring, which can hardly be distinguished from the head. The next ring has a long dorsal cirrus (*c'*), fully as long as the central tentacle (*a*), though somewhat more slender. The six rings following have a dorsal cirrus (*c''*) of the length of the tentacular cirrus (*c*). The rings of the body increase gradually in width towards the middle, and then taper off towards the tail. The dorsal cirri of these six rings are all of the same length; but beyond

\* See also Grube, q. a., who does the same.



those rings the dorsal cirri gradually increase in length, reach their maximum about the middle of the body, and then diminish again in the same ratio towards the tail, where they are hardly perceptible. The rings following the six rings, with dorsal cirri of the same length, differ in many respects from them. In the former there are two bunches of bristles, the dorsal made up of long, thin, needle-like bristles (Pl. IX., fig. 5), supported by a tubercle (fig. 4, *h'*), which are not retractile, and a ventral cluster (fig. 4, *h*) made up of shorter, stout bristles (Pl. IX., fig. 6). They are composed of two joints, the smaller exterior joint having the shape of a claw. The ventral bristles are retractile, and easily movable. These long, needle-shaped bristles are wanting in the anterior rings, which are not provided with a dorsal tubercle (see Pl. IX., fig. 3), and have only a ventral tubercle supporting the short, stout, retractile bristles like those of the posterior rings.

The eggs, in their earlier stages of development, are found thickly packed between the walls of the alimentary canal and the outer wall, on each side of the body for its whole length. The eggs, however, do not attain their maturity in the cavity of the body. As they develop, and fill more and more the space between the wall and the alimentary canal, some of them even finding their way into the dorsal cirri, there is developed on the lower side of the body a large bag, into which they pass. This pouch extends from the 12th to the 25th or 26th ring when fully swollen with eggs; it has an elliptical shape (Pl. IX., fig. 2), with a slightly wavy outline, the length of the smaller axis of this ellipse being about three times the breadth of the body. In this bag, which communicates freely with the cavity in which the eggs are formed, the eggs come to maturity; and soon after the young embryos have been hatched from the eggs, the envelope of the pouch bursts, and the young are left to swim freely about.

The anal cirri are more flattened than the dorsal, and are as long as those of the anterior rings. They are almost always wanting, dropping off a few days after the separation of the female from the parent stock.

The general appearance of the male is entirely different from the female, (see Pl. XI., fig. 8): the body, instead of tapering gradually from the middle towards both extremities, attains its greatest width much nearer the head, about the 12th ring. The number of rings which are not provided with long setæ, and have short dorsal cirri, are five, instead of six as in the females. The spermatazoa (Pl. XI., fig. 8, *o*), are found on the sides of these six rings only, and extend also into the cirri, but never into the posterior rings, as is the case with the eggs of the female which fill the cavity on both sides of the alimentary canal for the whole length of the body. The dorsal cirri of the male are shorter than those of the female, both in the anterior and posterior rings. The greatest and most striking difference we find in the head and in the first ring. (See Pl. IX., fig. 7 and Pl. XI., fig. 8.) The two large tentacles which are placed slightly in advance of the eyes, instead of being, as in the female, simple tentacles having the same breadth and rounded at the extremities, are very broad at the base where they are united by a prolongation of the anterior part of the head. At a small distance from the head they bulge out, giving the two tentacles the appearance of having been united and separated afterwards by a punch, the two swellings almost meeting and leaving only a round space between the two tentacles, which divide into two branches (see *a'* and *a''*, Pl. XI., fig. 8) at the extremity; the inner side of this tentacle is thickly covered with minute ciliæ. The median tentacle, *a*, is much larger than that of the female, and takes its origin farther back, directly above the opening of the mouth (*m*), between the two large dorsal cirri (*c'*). Directly behind the eyes we find a

small cirrus (*c*), as in the female; but when the animal is seen from below, as in Pl. XI. fig. 8, we notice an additional, still smaller cirrus (*c'''*) which is entirely wanting in the female, as well as the small tentacular cirri (*a'''*) (Pl. IX., fig. 7), which are found at the base of the tentacles (*a'* and *a''*) on the upper side of the head. The large dorsal cirri of the first ring are usually carried slightly curved back at the extremity (Pl. XI. fig. 8, *c'*). The needle-shaped bristles are somewhat longer than those of the females; otherwise neither these nor the hooked bristles differ in any way in the two sexes. The alimentary canal, in both the males and females, is narrower while it passes through the anterior rings (*f*), which have only stout bristles, widening suddenly as it reaches the rings where the setæ begin (*f'*).

Besides these two sexes differing to such an extraordinary extent, there is still a third kind of individual (Pl. X., fig. 1), which is neither male nor female, never has either eggs or spermatozoa developed, and differs more from the males than they differ from the females, and yet belongs to this same species. In fact, these individuals are the parent stocks, as I have called them above, from which are developed by transverse division males and females (Pl. IX., fig. 9). We cannot call this mode of reproduction a case of budding: it is the development of a head and all its appendages, either male or female, and the gradual addition of a very small number of rings, between this head and the tail-ring, which was at first a part of the parent stock, and remains the tail-ring of the male or female after it has separated from the parent stock; a large portion of the original parent stock becoming separated, to form part of individuals which alone have the power of developing eggs and spermatozoa, this power being entirely wanting in the parent stock. We have here, therefore, an actual case of alternate gen-



eration, just as much as in the case of the "*Strobila*;" an individual entirely different from the males or females, from which are developed, by a peculiar mode of transverse division, those very males and females which have spermaries and ovaries. These eggs, as I shall show below, instead of developing into males and females, are transformed into these parent stocks; which produce in their turn individuals having sexual organs, by transverse division, and never any thing else. During a whole summer I have had daily a large number of these worms alive; and have traced individuals raised, from the eggs until they reached the condition of the parent stock, upon which I was observing the growth of the males and females.

The parent stock (Pl. X., fig. 1) has the same color as the males and females. The tentacles of the head are like those of the female, the middle tentacle being longer, however; while the first ring instead of being consolidated with the head, as in the males and females, is distinct from it, and on each side of it we find two cirri, one long one (*C*), and a short one (*C'''*) in advance and below it. The second ring has a long dorsal cirrus (*C'*) on each side, corresponding to the cirrus *c'* of the males and females. The third ring has a shorter dorsal cirrus (*C''*) of the length of the cirrus *C'''*. The succeeding rings all have cirri, diminishing in length as they recede from the head, until near the tail, which has two large cirri, where they are hardly perceptible. In place of the large, highly-developed eyes of the males and females, we find two large and two small eyes, which are mere accumulations of pigment cells. The larger eye is placed below in advance of the smaller, and is nearer the edge of the body, the small eyes being quite close together (Pl. X., fig. 1, *O*). The rings are provided only with one kind of bristles, the short stout ones, exactly like those of the males and females (Pl. IX.,



fig. 6). The lower tubercle (*h*) (Pl. IX., fig. 3,) is more developed, and the bristles are placed nearer the dorsal cirrus, than is seen in that figure.

This lower tubercle is proportionally well developed in the anterior rings, diminishing in size as the dorsal cirrus becomes smaller. The dorsal cirri are much flatter and more pointed than is the case with the sexual individuals. We find, also, a great difference in the alimentary canal of the parent stock; the anterior portion is specialized to a degree which does not exist in the males and females; where the alimentary canal is simply the cutting off of a portion of the tube forming the common digestive cavity of the parent stock and the sexual individual while they were still attached. We have in the parent stock a narrow tube (œsophagus), winding from the mouth to a kind of true stomach, (Pl. XI., fig. 9); thence the alimentary canal passes as a wide, almost straight, tube through the whole length of the body.

The parent stock has from forty to forty-five rings before the swelling which eventually forms the head of the sexual individual can be distinguished. This swelling, without exception, is found on the upper side of the thirteenth or fourteenth ring, or one of the adjacent rings, (Pl. IX., fig. 9); and I have never seen a single case among the great number which I have observed, where this swelling of the head appeared in any other place. As a general rule, it was on the thirteenth ring that the head was developed. As the central swelling increases, there are formed on the two sides of this ring (see Pl. IX., fig. 11,) two additional swellings, (*a'*, *a''*), which soon become as large as the middle one. They increase in size very rapidly, and soon outstrip the middle swelling, (Pl. IX., fig. 12). These three swellings are the tentacles of the head. The large eye next makes its appearance, (Pl. IX., 13, *b*), and also the dorsal cirrus (*c'*). After this has reached the

length of the tentacles of the head, the second eye can be distinguished, (Pl. IX., fig. 17). At this point the three tentacles of the head and the dorsal cirrus have about the same length. If we trace further the development in different individuals, we find that there is a marked difference in the growth of the tentacles in parent stocks which are identical; and this difference in the growth of the tentacles is a sexual difference, the tentacles of the males being developed in one way, and those of the females in an entirely different manner. When the head of the young has reached the state represented in Pl. IX., fig. 15, if it is a male we soon notice on the inner side of the lateral tentacles ( $a'$ ,  $a''$ ) a slight swelling, (Pl. IX., fig. 19); the tentacle soon divides at this point by sending out a short branch, which grows larger and larger, (Pl. IX., fig. 20); the tentacles remain attached together at the base. In the development of the same tentacles in the female, we have simply a lengthening of the tentacles, and a tendency in the three tentacles to become well separated. So that a female would gradually pass from the state represented in Pl. IX., fig. 17, to that of Pl. IX., fig. 18. The head becomes more and more distinct; the small, tentacular cirri ( $c'''$ ) (Pl. IX., fig. 20) of the males become visible as a slight protuberance on the lower surface, when the tentacular cirrus ( $c$ ) is about one half as long as the tentacle. At the same time in the males the long dorsal cirrus ( $c'$ ) and the middle tentacle ( $a$ ) assume the curled attitude in which they are usually carried by them, while in the females these tentacles simply increase in length, the tentacle ( $a$ ) always being carried in advance of the head, and not turned back as in the males. The five rings following the head in the males (six in the case of the females), undergo scarcely any change, with the exception of a slight elongation of the dorsal cirri, (compare Pl. IX., figs. 1 and 9 and Pl. XI., fig. 8); but in the succeeding rings very striking differences are

observed: the dorsal cirri increase still more in length, a slight protuberance is formed immediately below the dorsal cirrus, from which a bundle of fine, needle-like bristles, like those of Pl. IX., fig. 6, are developed. Thus the anterior rings have two bunches of bristles, as in the adult males and females, and the upper bunch attains its full size before the young separates from the parent stock. The eggs and spermatozoa are likewise developed; and we find females whose bodies are entirely filled with eggs on each side of the alimentary canal, while they are still attached to the parent stock. While in the parent stock, in the twelve anterior rings, not the least trace either of eggs or spermatozoa could be detected. In the males the anterior rings alone are filled with spermatozoa.

The parent stock, with the sexual individual attached, moves freely about, leaving its case (Pl. XI., fig. 10) and returning to it. The males and females, after they have separated from the parent stock, do not build cases, but creep along the stems of Campanularians, and are often found swimming about in the bay. The parent stock, with the proliferous individual attached, is very sluggish in its movements, especially towards the time of separation of the male or female; when the latter has become so much more powerful than the parent stock that it guides all the motions by twisting its body from one side to the other, while the parent stock seems to be only an inert mass pushed about by its powerful and active young. The males and females lose the upper bunch of needle-like bristles, owing to the violence of their motion; and it is only just after they have separated that they have all their appendages, as they also lose with great facility the anal cirri. Soon after the females have become detached from the parent stock, the bag, into which the eggs are received before they are discharged from the cavity, is formed. This soon becomes very much distended with



young embryos, bursts, and then the females disappear. It is probable that they are killed by this, as I have never succeeded in finding a single female after it had discharged its embryos. The agamous individuals continue to live after the separation of the males and females. New rings are formed, (Pl. XI., fig. 7); and the same process apparently begins again, (Pl. XI., fig. 6,) as I have frequently found parent stocks from which sexual individuals had evidently already been separated, in the state represented in this figure. I am unable to say how many times this is repeated, and what is the length of life of the parent stock. They are found in large numbers on the stems of all the Campanularians of our bay, where they build their thin, transparent cases. Especially numerous upon those Campanularians which are attached to *Laminaria*. This same species I have also observed south of Cape Cod, in Buzzard's Bay.

I did not observe the young embryos while they were still inclosed in the bag of the female; my principal object being to satisfy myself about the alternate generation, and to see how far the mode of development by division from the parent stock agreed with the more advanced stages of the embryo after it had left the egg. The young, when it escapes from the bag in which the eggs come to maturity, is triangular, tapering very rapidly towards the posterior extremity (Pl. X., fig. 2); it has two large eyes quite distinctly marked. The alimentary canal (F) follows the outline of the young embryo; it has slightly undulating walls corresponding to two very faint constrictions, one directly behind the eyes, and the other at the same distance from the posterior end. There is no appearance of a mouth. In the next stage (Pl. X., fig. 3) the indentation behind the eyes becomes more deep, thus separating slightly the head from the rest of the body, the anterior part at the same time bulging out, (Pl. X., fig. 3, A), the



alimentary canal, as well as the young embryo, assuming a more elongated shape; and another constriction, placed about the middle, is noticed, dividing the alimentary canal into three regions. In the next stage (Pl. X., fig. 4,) the embryo is divided still more plainly by the constrictions, the three regions of the alimentary canal are more marked, the head with the eyes is more distinct, the triangular shape has completely disappeared, and the mouth can be seen as a small slit on the lower surface. In figure 5 three rings or folds of the skin extend across the embryo; the anterior portion of the alimentary canal has become still more narrow. Figure 6, which is figure 5, seen in profile, shows the position of the alimentary canal near the upper side, and the first appearance (*A*) of a slight swelling between the two large eyes, the rudiment of the middle tentacle. In the following stage (fig. 7) the lateral tentacles (*A'*, *A''*) appear as diminutive swellings in advance of the eyes. These soon outstrip in growth the middle tentacle (fig. 8), which in its turn makes up what it had lost, and the embryo takes the shape of (Pl. X. fig. 9); it has three short tentacles equally developed in the anterior part of the head; the anterior part of the alimentary canal is very narrow, widening suddenly when it opens into the main digestive tube. There are six rings, the anterior ring being provided with a bunch of stiff bristles, and the anal ring having on each side very small anal cirri (*E*). The number of rings formed, till an embryo reaches a certain state of development, does not seem to be constant: in figure 10, Pl. X., we have a larger number of rings, though the tentacles of the head are not as advanced as they are in figure 9. The tentacles of the head increase in length (fig. 12), two or three additional rings are formed, and bristles are found in each ring except the first and last. When it has reached this state (fig. 12) the embryo does not increase in length until the appendages

of the different rings are so well developed that it can be unmistakably recognized as a parent stock of Autolytus with a small number of rings (see Pl. X., figs. 13 and 14). Slight swellings having made their appearance on the sides of the first ring, then the second, and so on, and being gradually changed into the dorsal cirri, as seen in fig. 14, *C*, *C'*, Pl. X., the anal cirri increase in length; and by the time the last ring has a dorsal cirrus developed, the middle tentacle (*A*) (Pl. XI., fig. 1) has again outgrown the lateral tentacles, the tentacular cirrus (*C'''*) has been developed, and the worm has all the appearance of a parent stock with short cirri, (*C*, *C'*, *C'''*, *C''*). From this stage the development goes on very rapidly, the number of rings increases very fast, the tentacles and cirri grow to their full length soon after, and in a couple of weeks the embryo has passed through the stages represented in figures 2, 3, Pl. XI., and has reached its full size, (Pl. X., fig. 1,) when it is ready to begin the reproduction by division, as I have described it above.

If we compare the embryonic development of the parent stock from the egg to the development of the different parts of the male and female from the parent stock, we cannot fail to be struck with their perfect coincidence. The middle tentacle (*A*, *a*) is developed first in both, then the lateral tentacles of the head (*A'*, *A''*, *a'*, *a''*). The large eye is first visible, and then the smaller one; it is only when they are quite advanced that the long dorsal cirri make their appearance in the embryo and in the sexual individual; the long setæ of the latter developing at a time which corresponds to the formation of the stout bristles in the embryo; thus showing a perfect correspondence in the successive development of the different parts in these two modes of reproduction, and giving us a true perception of the value of embryological characters for classification. We cannot fail to see that the stages

through which the embryo *Autolytus* passes will give us valuable hints for the classification of Annelids. All the earlier stages, before the rings can be seen, have a very striking resemblance to the *Planarians*, and similar worms. They are flat, the eyes are simple accumulations of pigment cells, there are no divisions into rings perceptible, and the principal feature is the great development of the alimentary canal. In the next stage they become more elongated, the rings are strongly marked, there are rudimentary bristles, or gills in the case of the embryo of *Leucodore* and *Hæmatorhea*; and in this more advanced stage they recall to us the *Nematodes*, or round worms. In the still more advanced stages, the tentacles of the head, the division of the alimentary tube into distinct regions, the presence of well-developed cirri and setæ, represent the true Annelids; thus plainly placing, upon embryological data, the *Planarians* and the flat worms (*Platodes*), in which the great preponderance of the alimentary tube is the main feature, lowest; then the round worms (*Nematodes*), in which we have rudimentary gills, etc., next in rank; and ending with the true Annelids, in which we have the greatest specialization of the appendages of different rings. The number of worms whose embryology is well known is so small, that it is impossible to collect sufficient data for tracing out this correspondence as minutely as could be desired. It is apparent from these observations upon the alternate generation of the higher Annelids, that henceforth an accurate knowledge of their complete development will be necessary before we can arrive at any satisfactory conclusions with respect to their classification; that, since we know that species belonging to genera hitherto placed in different families are only different generations of one and the same species, we should be particularly cautious in characterizing genera however much they may apparently differ from one another.



## SPECIES OF AUTOLYTUS KNOWN AT PRESENT.

*Autolytus Grube.*

For synonyms see page 390.

*Autolytus prolifer Grube* q. a.; *Nereis prolifera O. F. Müller*; *Nereis corniculata O. F. M.*; *Diploceraea corniculata Grube*; *Syllis prolifera Johnst.*; *Sacconereis Helgolandica M. Müller*. *Polybostrichus Müllerii Keferst.\** England, (*Johnst.*); German Ocean, Helgoland (*M. Müller*).

*Autolytus longosetosus A. Ag.*; *Polybostrichus longosetosus Örst.* Greenland (*Örst.*); New England (*A. Agassiz*). *Autolytus Schultzii A. Ag.*; *Sacconereis Schultzii J. Müller*. Trieste (*J. Müller*).

*Autolytus cornutus A. Ag.* Coast of New England, *A. Agassiz*.

I have quoted *Autolytus longosetosus* as probably occurring on the coast of New England, as I found the "parent stock" of a second species of *Autolytus* which is much larger than the *A. cornutus*, and which may, on further investigation, prove to be the "parent stock" of *Autolytus longosetosus*. It reaches a length of more than an inch, has very broad and flat feet, and much longer stiff bristles than the parent stock of *Autolytus cornutus*.

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[Since this paper was written I have found the males and females of the parent stock mentioned above. The male agrees with the figure given by Örsted of *Polybostrichus longosetosus*. The female can easily be distinguished by the small size of the anterior pair of tentacles, and the great number of the anterior rings, no less than ten, which are not provided with long setæ. This species is quite common about the wharves in our harbor during the month of April, which is their breeding season.]

\* Zeit. f. Wiss. Zool. 1862, p. 113.



EXPLANATION OF THE PLATES.

PLATE IX.

(*Autolytus cornutus* — male and female.)

Fig. 1. — An adult female, full of eggs, seen from above, the eggs are placed in all the rings on each side of the alimentary canal (*f*); *a*, the middle tentacle of the head; *a'* and *a''*, the left and right tentacle in advance of the eyes *b*; *c*, the small tentacular cirrus placed behind the eyes on the lower side; *c'*, the large dorsal cirrus of the second ring developed into a tentacular cirrus; *c''*, the dorsal cirrus of the rings in which there are only one kind of bristles; *d*, the dorsal cirrus of the rings in which the two kinds of bristles are found; *m*, the mouth; *o*, the eggs; *f*, the anterior part of the alimentary canal.

Fig. 2. — The sac of a female in which the young parent stocks of *Autolytus cornutus* are developed previous to hatching. *O* shows this membrane and the young parent stocks in one side of it.

Fig. 3. — One of the feet of the rings provided with one kind of bristles; *c*, the dorsal cirrus; *h*, the tubercle from which project the hooked bristles.

Fig. 4. — One of the feet of the posterior rings provided with two kinds of bristles, lettering as in fig. 3; *h'*, the tubercle from which project the thin, needle-shaped setæ.

Fig. 5. — A bristle from the upper bunch of setæ.

Fig. 6. — Bristle, with sickle-shaped hook, taken from the lower bunch of bristles.

Fig. 7. — The head of a male seen from above. Letters as in fig. 8, Pl. XI., *a'''* being a small tentacular cirrus placed at the base of the forked tentacles.

Fig. 8. — Shows the shape of the dorsal cirri.

Fig. 9. — Parent stock, with a male of *Autolytus cornutus* attached, just ready to separate. The lettering of the male ready to be separated is the same as before. Correspond-

ing parts of the parent stock, and males or females are marked by the same capital letter, A, A'' being the middle tentacle and the right tentacle of the head; C, C', C'', C''' corresponding to *c c' c'' c'''* in the figures of males and females; F and F', the anterior and posterior part of the alimentary canal.

Fig. 10.— Still more magnified view of the head of a parent stock, letters as in fig. 9; M, the mouth; B, the eyes.

Fig. 11.— The ring of the parent stock, in which the tentacles of the head of the individual bearing the sexual organs can be noticed as slight swellings, *a, a' a''*.

Fig. 12.— The same ring, showing the lateral tentacles of the head (*a'* and *a''*) somewhat more developed than in the preceding figure.

Fig. 13.— Somewhat more advanced; the large eyes have made their appearance, and the long tentacular cirrus (*c'*) is seen behind the eye.

Fig. 14.— The same as fig. 13 seen in profile, somewhat more advanced, as the small eye can be detected as a minute spot above the large eye.

Fig. 15.— The head at the time when the three tentacles are equally developed; the small eye has not yet made its appearance, although the tentacles are more advanced than in fig. 14. This is a male, while the preceding figures were probably females.

Fig. 16.— Head of an individual which can with certainty be recognized as a female; the tentacular cirri are very small, *c, c'*.

Fig. 17.— The head of a male previous to the time when the tentacles begin to fork; the tentacle *a* is generally turned towards the tail in the males, and carried straight forward in the females.

Fig. 18.— Head of a female just before it is ready to separate from the parent stock.

Fig. 19. — Head of a male somewhat more advanced than that of fig. 15; there are two eyes, and the tentacles are forking.

Fig. 20. — Head of a male ready to separate; the middle tentacle *a*, as well as the long cirri *c''*, are carried tightly curled up.

#### PLATE X.

##### *Development of the Parent Stock.*

Fig. 1. — A full-grown parent stock previous to the formation of male and female individuals, seen from above.

As the embryos which develop from the eggs are the parent stocks from which the males and females are separated, the letters are all capitals, and correspond to those of fig. 9, Pl. IX.

Fig. 2. — A young parent stock of *Autolytus* just having made its escape from the sac.

Fig. 3. — The digestive cavity has become more insulated, the anterior part shows a tendency to differentiation. The body has lost somewhat its triangular outline.

Fig. 4. — The alimentary canal is divided into three distinct regions, and the body has assumed a more elongated form than in the preceding figures. Sinuosities indicating the rings are clearly seen.

Fig. 5. — The rings have become very distinctly marked, the head is more distinct from the rest of the body.

Fig. 6. — Fig. 5 seen in profile.

Fig. 7. — Head of a young parent stock of *Autolytus* somewhat more advanced than in preceding figures.

Fig. 8. — The lateral tentacles *A'*, *A''* extend beyond the body.

Fig. 9. — The tentacles of the head are all equally advanced; bristles appear at three of the rings; the caudal stiles are slight swellings on each side of the anal ring, *E*.

Fig. 10. — Although not quite as advanced as fig. 9, has one more ring.



Fig. 11. — Fig. 10 seen in profile ; the last ring seems to be divided into two, giving the figure the appearance of an additional ring.

Fig. 12. — Young parent stock of *Autolytus*, in which bristles are developed at all the rings, and the tentacles of the head somewhat more advanced than in fig. 9.

Fig. 13. — First appearance of the tentacular cirrus C. which is developed after the dorsal cirri C'' have been formed on two or three rings, as seen in the next figure.

Fig. 14. — The young parent stock of *Autolytus* has all the appearance of a full-grown parent stock, having a smaller number of rings, shorter tentacles, and smaller cirri.

Fig. 15. — A more enlarged view of the head of a parent stock slightly older than that of fig. 14.

#### PLATE XI.

Fig. 1. — The smaller tentacular cirri c''', the stiles of the caudal ring and the appendages of all the rings have been greatly developed since the stage represented in Pl. X. fig. 14.

Fig. 2. — The number of rings is greatly increased, and the cirri C and C' specially have lengthened.

Fig. 3. — Still more advanced individual.

Fig. 4. — A view of the head of a full-grown parent stock, seen from below, to show the mouth, M.

Fig. 5. — The thirteen rings remaining of the parent stock after the separation of the male or female individual, and the new rings formed since.

Fig. 6. — Parent stock in which new rings have been formed after the *Autolytus* has separated, and where the eyes of a second individual are perceptible.

Fig. 7. — The posterior extremity, in which the caudal stiles are formed preparatory to the formation of new rings, as in fig. 6.

Fig. 8. — A male, seen from the lower side. The letters



correspond to the same parts as those of the figure of the female (Pl. IX., fig. 1),  $a'$ ,  $a''$  being the forked tentacles which are peculiar to the males;  $c'''$ , a second cirrus placed beneath the small tentacular cirrus  $c$ , which is wanting in the female;  $o$ , are the spermaries, which are found only in the five rings preceding those where the long setæ begin;  $f'$ , the posterior part of the alimentary canal, which is wider than the portion leading from the mouth to the 7th ring;  $g$ , the lower side of the feet, showing deep grooves formed by the deeply indented rings, having the two kinds of bristles.

Fig. 9. — Showing the division of the alimentary canal (in the parent stock) into a small tube (œsophagus) ( $l$ ), leading from the mouth to a true stomach  $n$ , which empties into a large intestine ( $F'$ ) leading to the anus.

Fig. 10. — Case in which the parent stock of *Autolytus* lives;  $y$ , the case attached to a portion of the stem of a *Campanularia*.

ART. VIII. — *Materials for a Monograph of the North American Orthoptera, including a Catalogue of the known New England Species.* By SAMUEL H. SCUDDER.

[Read May 21st, 1862.]

THE North American Orthoptera have been very much neglected, very little special attention having been paid to them; for besides the earlier general works of Linneus, Fabricius, De Geer, Stoll, and Palisot de Beauvais, and the more recent ones of Burmeister and Serville, which included descriptions of North American Orthoptera among others, the only other notices of our species have been in the few scattered descriptions by Say, Hal-deman, Kirby, Girard, and myself, if we except only these two: — Harris's mention of the New England Orthoptera in his "Report on Insects of New England Injurious to

Vegetation," which, though very meagre indeed, is yet a fuller treatment of them than has been given by him to any other group in his Report; and De Saussure's short diagnoses of new species in the "Revue et Magasin de Zoologie," about three years since, which have reference principally to tropical forms.

My earliest intention in this paper was to restrict myself to a critical revision of the Orthoptera of New England, known to me, whether described or undescribed; and this has continued to be the main purpose of the article, in its present form,—more enlarged, because it was readily seen that a much better understanding might be obtained of the peculiarities of its fauna by comparisons, the more extended the better, with species closely allied from without its limits. This has been the case, particularly among the *Locustariæ*; and it is hoped that some better understanding may thereby be had of the Orthopteran fauna of the whole of North America.\*

To further my purposes I solicited the assistance of many of my friends, and have invariably received their kindest coöperation. The original collection of Dr. T. W. Harris, in the Society's possession, has been invaluable to me; for by it I have been enabled to know exactly the extent of his knowledge of our fauna, as well as to determine his species directly from his types. The collection of the Museum of Comparative Zoölogy has been of great assistance to me,—containing as it does many species I could not otherwise have seen from the southern

\* The whole number of species mentioned is 115, of which 78 are found in New England, distributed among the different families as follows:—

	Whole No.	From New England.
Forficulariæ . . . . .	2	2
Blattariæ . . . . .	9	7
Phasmida . . . . .	1	1
Gryllides . . . . .	14	11
Locustariæ . . . . .	41	16
Acrydii . . . . .	48	41
	<hr/> 115	<hr/> 78

and western portions of our country, — besides the New England collection of Mr. A. Agassiz. To Mr. P. R. Uhler, of Baltimore, — almost the only one in our country who studies the Orthoptera, — I am greatly indebted, both for many valuable suggestions, and for some very interesting insects from various parts of our Union, and especially for the opportunity of examining many species of *Ceuthophilus*, new to me. From Mr. F. G. Sanborn I have received very rich collections from Massachusetts, including the Orthoptera of the State Cabinet. My thanks are also due to Miss A. M. Edmands, of Cambridge; Messrs. C. A. Shurtleff, of Brookline, Mass.; Edward Norton, of Farmington, Conn.; and A. S. Packard, Jr., of Brunswick, Me., who have generously placed all their collections from their several vicinities in my hands, and to Mr. C. Thomas, of Murphysboro', Illinois, for many specimens from that State. By my own collections along the route taken by Sir John Richardson in Northwest America, I have been enabled to determine the few species described by Kirby, as well as to add others to its fauna, and by specimens collected for a number of years in the New England States, to add considerably to my material for this investigation.

Such have been my opportunities for the study of our Orthoptera, so far as native species are concerned; but there have also been of very material assistance to me in generic determinations, — the large series of European Orthoptera in the Cambridge Museum, — and a very fully represented and beautiful collection of European species which I have received from Herrn Brunner von Wattenwyl, who has in his possession the original collection which formed the basis of Fischer's elaborate work.

I have only made mention in this paper of species which I have myself seen, with but a single exception — *Ceuthophilus scabripes*, and have endeavored to verify



every synonymical reference. Of the work of Stoll, I have only been able to make a hasty examination, without the opportunity of direct comparison with specimens; and the references to Palisot de Beauvais are not so complete as they would have been had I ever seen a perfect copy. In my references to Harris's Report, I have quoted the last (third) edition only, because it is better known, has illustrations of many species, and there has been no essential alteration in the text of the three editions. To those who would not otherwise understand the claim of prior description in some cases, I would say that the first edition was published in 1841. I have also made full references to his "Catalogue of the Insects of Massachusetts," (published in 1835, in Hitchcock's "Report on the Geology, Mineralogy, Botany, and Zoölogy of Massachusetts," and also in a smaller volume extracted from it, under the title, "Catalogue of the Animals and Plants of Massachusetts,") not because the names given there have any value in questions of priority, but because Dr. Harris had sent away many collections correspondingly labelled.

To prevent misunderstanding, I may state that where I have not indicated the number of specimens examined, it is to be taken for granted that I have seen a considerable number; and where no reference is made to the sexes seen, I have examined both. The measurements given have been, so far as possible, average measurements. The length of the body has been given as a straight line, connecting (in the natural attitude of the Orthopteron) the tip of the vertex and the extremity of the abdomen — excluding the ovipositor in the females of Gryllides and Locustariæ, and including the inarticulated abdominal appendages in the males; the length of the ovipositor is given as a straight line, connecting its tip with the point of junction of the upper and lower valves at its base.



For more easy reference I have prefixed an asterisk (\*) to such species as I have seen from New England. In giving localities, I have only referred to those from which I have myself seen specimens, and have appended to them the names of the collectors; or where that was not known, the person from whom I received them.

I add here a Table for the more ready determination of the genera, which I have made as simple and concise as possible. It is strictly limited to the genera of New England, and is not intended for reference to the species outside its limits.

A TABLE TO FIND THE GENERA OF NEW ENGLAND ORTHOPTERA.

1. Hind legs longest; hind femora thickened . . . . . 4
1. Legs of nearly equal length; hind femora not thickened . . . . . 2
  2. Abdomen armed behind with a forceps . . . . . (*Forficulariæ*) 6
  2. Abdomen not armed behind with a forceps . . . . . 3
3. Body broad and flat . . . . . (*Blattariæ*) 7
3. Body long and exceedingly slender, with slender legs. (*Phasmida*)  
Diapheromera.
4. Antennæ long and tapering . . . . . 5
4. Antennæ short . . . . . (*Acrydii*) 23
  5. Wing covers with the outer portion bent abruptly downwards. (*Gryllides*) 11
  5. Wing covers sloping downwards at the sides . . . . . (*Locustariæ*) 15

FORFICULARIÆ.

6. Antennæ with less than 12 joints . . . . . Labia.
6. Antennæ with more than 20 joints . . . . . Labidura.

BLATTARIÆ.

7. Winged . . . . . 8
7. Wingless . . . . . Pycnoscelus.
  8. Females with developed wings . . . . . 9
  8. Females with rudimentary wings . . . . . Stylopyga.
9. Basal joints of tarsi longer than the others . . . . . 10
9. Basal joints of tarsi shorter than the others . . . . . Ectobia.
10. Supraanal plate deeply fissured . . . . . Periplaneta.
10. Supraanal plate not deeply fissured . . . . . Platamodes.

GRYLLIDES.

11. Fore-tibiæ broad . . . . . 12
11. Fore-tibiæ slender . . . . . 13
  12. Insect large . . . . . Gryllotalpa.
  12. Insect small . . . . . Tridactylus.
13. Hind-femora stoutish . . . . . 14
13. Hind-femora slender . . . . . Ceanthus.

14. Last joint of the maxillary palpi of the same length as the penultimate . . . . . Gryllus.  
 14. Last joint of the maxillary palpi double the length of the penultimate . . . . . Nemobius.

## LOCUSTARÆ.

15. Wingless, or with rudimentary wings and wing-covers . . . . . 16  
 15. Winged . . . . . 17  
 16. Wingless; pronotum not extended over meso- and metanotum . . . . . Ceuthophilus.  
 16. With rudimentary wings and wing-covers; pronotum extended  
     over meso- and metanotum . . . . . Thyreonotus.  
 17. Wing-covers expanded in the middle . . . . . 18  
 17. Wing-covers not expanded in the middle . . . . . 20  
 18. Wing-covers much broadened in the middle, concave . . . . . Cryptophyllus.  
 18. Wing-covers somewhat broadened in the middle, not concave . . . . . 19  
 19. Ovipositor very small . . . . . Microcentrum.  
 19. Ovipositor of medium size . . . . . Phylloptera.  
 20. Vertex of the head with a conical projection forwards . . . . . Conocephalus.  
 20. Vertex of the head without a conical projection . . . . . 21  
 21. Ovipositor straight, or very nearly so; insect small . . . . . Xiphidium.  
 21. Ovipositor curved; insect large . . . . . 22  
 22. Ovipositor curved sharply upwards . . . . . Phaneroptera.  
 22. Ovipositor ensiform . . . . . Orchelimum.

## ACRYDII.

23. Pronotum produced backwards, covering abdomen . . . . . 31  
 23. Pronotum not produced backwards over abdomen . . . . . 24  
 24. Antennæ broad and flattened at base, acuminate . . . . . Opomala.  
 24. Antennæ filiform, or slightly flattened . . . . . 25  
 25. Prosternum with a slender central spine . . . . . 26  
 25. Prosternum without a spine . . . . . 28  
 26. Sternal spine prominent . . . . . 27  
 26. Sternal spine but slightly raised . . . . . Arcyptera.  
 27. Lateral carinæ of pronotum more or less prominent; medial carina scarcely  
     elevated; extremity of abdomen of males much swollen . . . . . Caloptenus.  
 27. Lateral carinæ of pronotum wanting; medial carina generally prominent;  
     extremity of abdomen in males not swollen . . . . . Acridium.  
 28. Front, nearly perpendicular, generally swollen; vertex not prom-  
     inent . . . . . Edipoda.  
 28. Front considerably oblique, sloping inwards; vertex prominent . . . . . 29  
 29. Hind-border of pronotum sharply angulated . . . . . Tragocephala.  
 29. Hind-border of pronotum docked or rounded . . . . . 30  
 30. Foveolæ on the vertex; lateral carinæ of pronotum incurved . . . . . Stenobothrus.  
 30. No foveolæ on the vertex; lateral carinæ of pronotum parallel or nearly  
     60 . . . . . Chloëaltis.  
 31. Pronotum arched roundly . . . . . Batrachidea.  
 31. Pronotum nearly or quite horizontal . . . . . 32  
 32. Antennæ 13-14 jointed . . . . . Tettix.  
 32. Antennæ 22 jointed . . . . . Tettigidea.

FORFICULARIÆ, Latreille.

SPONGOPHORA, SERVILLE *Emend.*

\* 1. *S. BIPUNCTATA*, nov. sp.

The head, antennæ, and prothorax are reddish brown; eyes black; elytra darker brown, with a rather large pale spot equi-distant from the base and either border; wings at rest, extending nearly twice as far back as the elytra, pale, with a dark brown band along the inner edge beyond the elytra; there is a faintly impressed longitudinal line on the prothorax. Length from front of prothorax to tip of wings, .3 in.

I place this species in this genus with some degree of doubt, because I have but a single mutilated specimen to examine, which wants abdomen and legs, the elytra and wings of one side, and the principal part of the antennæ; but the parts that remain exhibit good specific characters.

Mass. (H. Coll.) Taken May 30. 1 specimen.

LABIA, LEACH.

\* 1. *L. MINUTA*, nov. sp.

Thorax, elytra, and exposed portion of wings yellowish brown, covered with shortish hairs; middle of abdomen reddish brown; sides of the abdomen above and the head dark reddish brown approaching a black; last segment of abdomen and forceps reddish brown; abdomen also and forceps thickly beset with shortish hairs; legs shining pale yellow; parts of the mouth and antennæ yellowish brown; abdomen beneath brownish yellow; ♂ forceps slender, of nearly equal width throughout, curving outwards slightly at the middle, and then inwards towards the tip; slightly falciform, and meeting only at the tip; minute triangular black teeth on the lower inner edge; ♀ forceps diminishing in size to the tip, which is very slightly curved inwards; otherwise they are straight, meeting along the whole inner edge, which is toothed as in the ♂; tips as

united together rounded, very slightly shorter than in the ♂. Length of whole body, .2 in.; forceps, .04 in.

Mass. (H. Coll., November 4, 1845, flying in evening; Shurtleff, Aug. 28.) Virginia, (Uhler.) imperfect specimen; 3 ♂, 1 ♀.

#### BLATTARIÆ, Latreille.

*Stylopyga*, Fischer, having been proposed as a genus for the reception of *Blatta orientalis* L., before *Periplaneta* of Burmeister, must be retained for it; but since *B. americana* L. must be placed in a different genus from *B. orientalis*, we may reserve *Periplaneta* for that species with its allies, and the more properly since it is mentioned first under the genus by Burmeister. The two genera will be found to differ not only in the rudimentary condition of the wings in the females of *Stylopyga*, but also in the wings of the males, which are much shorter than the body in *Stylopyga*, and longer than the body in *Periplaneta*; the outer border also of the anterior pair is much less rounded in the former than in the latter, while another character is found in the deep fissuration of the supraanal plate in *Periplaneta*, which is almost wholly wanting in *Stylopyga*, where it is squarely docked, instead of being pointed, as in *Periplaneta*.

#### STYLOPYGA, FISCHER DE W.

\* 1. *S. ORIENTALIS*, Fisch. d. W., Bull. d. Nat. de Moscou; VI. 366. (1833.) For synonymy, see Fischer, Orth. Eur.

Seaboard of Mass., (H. Coll., Shurtleff, Sanborn, S. H. S.) N. York, (S. H. S.) Maryland, (Uhler.) The proportions of the length of the elytra to their breadth in this species and in *Periplaneta Americana* are very variable.

#### PERIPLANETA, BURMEISTER.

\* 1. *P. AMERICANA*, Burmeister, Handb. d. Ent.; II. 503. (1838.) For synonymy, see Fischer, Orth. Eur.; to which



add ♀ *Blatta domingensis*, Pal. de Beauv., Ins.; 182, Pl. 1 b., fig. 4. (1805.)

Seaboard of Mass., (H. Coll.) Indiana, (Mus. Comp. Zoöl.) Mexico, (Uhler.) Texas, (Mus. Comp. Zoöl., Uhler.)

PLATAMODES, Nov. gen. (πλαταμόδης.)

A genus more closely allied to *Periplaneta* than to any other, but readily distinguishable from it by its much narrower and more elongated body, — the sides being sub-parallel to one another throughout their whole extent, while in *Periplaneta* the abdomen is much swollen. The wings and wing-covers extend beyond the abdomen, the latter being well rounded at the tip. The supraanal plate is regularly rounded, but lacks altogether the fissuration seen in *Periplaneta*; but at the same time it is not squarely docked as in *Stylopyga*. The anal cerci are somewhat shorter, and not so flattened as in *Periplaneta*, while the anal styles are very short and turned abruptly downwards. In *Periplaneta* the sub-genital plate does not extend so far backward as the supraanal. In *Platamodes* it extends backward farther. A further distinction between the two genera may be seen at the inner borders of the eyes, which in *Platamodes* are nearly parallel; while in *Periplaneta* they approach one another anteriorly. I have only seen males.

1. P. PENNSYLVANICA.

*Blatta pennsylvanica*, De Geer, Mem.; III. 537. Pl. 44, fig. 4. (1773.)

“ “ Oliv., Enc. Meth.; II. 317. (1791.)

Indiana, (Mus. Comp. Zoöl.) Maryland, (Uhler.) 5 ♂.

\* 2. P. UNICOLOR, nov. sp.

*Blatta pennsylvanica*, H. Cat.; 56, (non De Geer.)

*Blatta rufescens* and *bicolor*? H. Cat.; (non Pal. de Beauv.)

Wings and wing-covers uniform pale shining reddish brown; head and prothoracic shield nearly the same, but

slightly darker, particularly in the middle of the latter; abdomen a little darker above, especially on the borders; cerci dark brown; legs, especially the tibiæ, darker than the body; eyes black; antennæ and palpi brown; antennæ reaching backwards to tip of wing-covers. Length of body, .25 in.; length to tip of wings, .35.

"In woods, under stones, and entering houses by night in June." — H.

Mass., (H. Coll., Sanborn.) 6 ♂.

ECTOBIA, WESTWOOD.

\* 1. *E. GERMANICA*, Stephens, British Entomology; VI. 46. (1835.) For synonymy, see Fisch., Orth. Eur.; to which add *Blatta parallela*, Say Mss. and H. Cat.; 56.

Mass. (H. Coll., Shurtleff, Sanborn, S. H. S.) Vt., (Mus. Comp. Zoöl.) N. York, Maryland, (Uhler.)

\* 2. *E. LITHOPHILA*, Harris Mss.

I have not seen any winged individuals of this species. Immature specimens are of an uniform bright brownish red upon the head and thorax, with the abdomen growing darker posteriorly and laterally; the legs are of a bright shining yellow, a little dusky, with rather long delicate spines placed irregularly upon the edges, the femora being tipped with one slightly curved; cerci blackish; eyes black; palpi dusky; antennæ light brown; third joint of antennæ as long as the succeeding five taken together, and twice as large as the second; in *E. germanica* it is only slightly larger than either of the succeeding, and of the same size as the second. Length, .4 in.; breadth, .2 in. An öötheca of this species (or so labelled by Harris), is similar in general appearance to that of *E. germanica*, but is shorter; it measures — Length, .2 in.; breadth, .1 in.; thickness, .07 in. There are nine transverse depressions. "Under stones; very common in woods. April 20, 1834." — H.

Mass. (H. Coll., Shurtleff, Sanborn, S. H. S.)

\* 3. *E. FLAVOCINCTA*, nov. sp.

Prothoracic shield rather dark brown, slightly paler along the median line, bordered throughout with a pale yellowish band, forming only a very narrow edge posteriorly; broader in front, and quite broad at the sides, covering all the deflexed border; the edge at the sides and in front is slightly raised; wing-covers scarcely reaching tip of abdomen, reddish brown, with the anterior half of the outer margin paler, with a yellowish tinge; wings not half the length of the wing-covers; abdomen above very dark brown; below dark brown, the terminal segment being darkest; legs yellowish brown, with spines as in *E. lithophila*; head reddish brown; sides below antennæ yellowish; eyes black; antennæ dark brown, paler toward tip; third joint rather larger than the two succeeding joints, and equal in size to the second. Length of body, .56 in. "In woods, under a stone."—H.

Mass. (H. Coll.) Western States, (Mus. Comp. Zoöl.) Lake Superior, (Mus. Comp. Zoöl.) 3 specimens.

## CRYPTOCERCUS, Nov. gen. (κρυπτὸς, κέρκος.)

A genus allied to, but very distinct from, *Polyzostæria*, Burm. The head is not large, much flattened, front sloping strongly inwards; prothorax broader than long, considerably arched, swollen, with the front border extending over the head slightly upturned to form a sort of hood; border of prothorax thickened in front considerably, at the sides more narrowly, here forming a slightly raised edge, which extends along the whole side of the body. Both sexes wingless; the meso- and metathorax not so arched as the prothorax; the hind border of the mesothorax not turned backwards at outer angle; that of the metathorax only in a very slight degree; abdomen not flattened, but quite full, especially on posterior half; the abdomen slightly longer than the thorax; the segments nearly equal in width, with the exception of the



last (seventh) which is very large, triangular, three times the width of the sixth, produced posteriorly to a blunt rounded apex, the segment concealing the abdominal appendages altogether; the abdomen is a little longer than broad, regularly and but little rounded at the sides. The eyes are small, reniform, subglobose, the longitudinal diameter lying in the plane of the head; no ocelli; antennæ inserted in a broad circular depression, and about half the length of the body; first joint twice as long as the second, second as long as the third and fourth, third as long as the fourth and fifth; the terminal joints somewhat moniliform, the whole profusely covered with short hairs; third and fourth joints of the maxillary palpi equal, the last a little longer, considerably thickened at the termination. Legs compactly fitted to one another beneath the spreading sides of the thoracic segments; the femora broad, short, flattened, smooth, without a trace of spines, save one or two small ones at the tip upon the hind border, generally upon the upper edge only; tibiæ of fore legs very short and heavy, thickened at the tip; those of the other legs similar in character, but becoming longer posteriorly, — all thickly covered with heavy spines; tarsi with the first and last joint nearly equal in length, (on the anterior pair the last is much the longest) and equal to the three middle joints; well-developed claws, but with no pad between them; the abdominal appendages cannot be seen except through the gaping of the dorsal and ventral shields of the seventh segment; the cylindrical hairy cerci in both sexes are so long as just to reach the apex of the triangular supraanal plate; the styles of the ♂ are very small.

1. *C. PUNCTULATUS*, nov. sp.

Above of an uniform dark shining mahogany-brown color, a little deepest at the posterior extremity; beneath a little lighter, with a reddish yellow tint, especially upon the coxæ, and to be seen also on the mouth parts and the sockets of the antennæ; antennæ dirty brown; the whole



body thickly covered with punctures, most abundant and largest upon the upper surface of the seventh segment, where also the edges are raised; beneath they are more distant; upon the head they are minute; there is a faintly impressed median line along the thoracic segments, excepting upon the hood-like projection of the prothorax; the anterior half of the raised edge of the sides of the prothorax is externally indistinctly grooved; the ♂ is a little more arched upon the thoracic segments than the ♀. The dorsal shield of the seventh segment is slightly excavated at the tip in both sexes; and the ventral shield in the ♀ is a little indented upon either side of the tip. Length, ♂ .8 in.; ♀ .86 in. Breadth across third abdominal segment, ♂ .38 in.; ♀ .36 in. Breadth across mesothorax, ♂ .34 in.; ♀ .30 in. Depth in middle of abdomen, ♂ .13 in.; ♀ .17 in.

♂ Draper's Valley, Virginia, (H. E. Scudder.) ♀ N. Y., (Uhler.) Penn., (H. Coll.) 3 specimens.

PYCNOSCELUS, Nov. gen. (πυκνὸς, σκέλος.)

A genus allied to the preceding, the males of which are wingless. I have no specimens of the female.

Head as in *Cryptocercus*, but proportionally larger; thoracic segments, and especially prothorax, very much arched, so as to form nearly a semicircle; prothorax only a little broader than long; the hind edge straight; the edge of the front and sides as well as the sides of the meso- and metathorax turned upwards very slightly, forming a delicate rim; the hind border of the meso- and metathorax is curved backwards a little at the outer angle; wings entirely wanting; the abdomen is very much expanded and flattened to a thin sheet posteriorly, so as to show no arching whatever; the segments narrow very rapidly towards the extremity, so that the hind curve is very broad and regular; the abdomen is half as broad

again as long, and only equals in length the pro- and mesothorax together; hind edge of the seventh segment straight, but curved backwards somewhat at the outer angle; segments nearly uniform in length along the median line. The eyes are of moderate size, uniform with the surface of the head, nearer to one another than in *Cryptocercus*, pyriform, the broadest portions toward one another, the longitudinal diameter lying in the plane of the head; the antennæ are slender, not exceeding half the length of the body; the first joint not large, swollen at tip, and twice as long as the second, which with the succeeding is cylindrical; the third is as long as the first, and equals the succeeding four in size; all the joints are covered with very short hairs; the thoracic segments much hollowed below, giving space for the legs, which may be packed so closely as not to appear above the plane which unites the edges of the segments. Legs similar in every respect to those of *Cryptocercus*, except that the tibiæ are more flattened; and there is a distinct though small pad between the claws. The supraanal and the subgenital plates, which are exactly similar in character, are thrice as broad as long, regularly curved behind, with a slight fissuration in the middle, making them slightly bilobed; the cerci are very small but stout, pointed, flattened, with a medial ridge, nearly as broad at base as long, smooth, without trace of annulation; the styles are slender, cylindrical, bluntly pointed, of about the length of the cerci and inserted just within them.

\* 1. *P. obscurus*, nov. sp.

Of an uniform reddish brown above and below, shining upon the whole surface with the exception of the upper surface of the abdominal segments succeeding the third; head, thorax, and first three abdominal segments above with minute and distant punctures; upon the dulled surface these are exchanged for minute raised points, irreg-

ularly scattered over the general surface, becoming larger and bead-like upon the posterior borders of the segments, where they are equi-distant; these last are also found upon the posterior border of the third segment; a very faintly impressed median line upon the prothorax; the eyes are black; the antennæ dusky brown; the parts of the mouth yellowish brown; the legs the same, with a reddish tinge; the segments of the abdomen beneath have no punctures. Length, .46 in.; length of abdomen, .19 in. Breadth at hind border of prothorax, .19 in.; breadth at fourth abdominal segment, .29 in.; length of cerci, .015 in.

Greenfield, Mass., (Sanborn.) "In woods, under stones."  
1 specimen.

PHASMIDA, Leach.

DIAPHEROMERA, GRAY.

\* 1. D. FEMORATA.

- Spectrum femoratum*, Say, App. Long's Second Expedition; 297. (1824.)  
 " " Say, Am. Ent.; III. pl. 37. (1828.)  
 " " Say, Ent. of N. Am. (Ed. Le Conte.) I. 82, 197. (1859.)  
 " " Harris, Cat. Ins. Mass.; 56. (1835.)  
*Diapheromera Sayi*, Gray, Synopsis of Phasmidæ; 18. (1835.)  
 " " Serville, Hist. Nat. d. Orth.; 247. (1839.)  
 " " Charp., Orth. Descr. et Depict.; Pl. 6. (1841.)  
 " " Westw., Brit. Mus. Cat., Orth., Part I. Phasmidæ; 20. (1859.)  
*Bacteria (Bacunculus) Sayi*, Burm., Handb. d. Ent.; II. 566. (1838.)  
 " " " Burm., Zeitschr. f. Ent.; II. 39. (1840.)

*Bacteria femorata*, Haldeman in Icon. Encyc. (1857.)

*Bacunculus femoratus*, Uhler in Harris, Inj. Ins., 3d ed.;  
146. (1861.)

Mass., (H. Coll., Sanborn, S. H. S.) N. H., (H. Coll.)  
Illinois, (Uhler.) Red River Settlements, British America,  
(S. H. S.) Nebraska, (Mus. Comp. Zoöl.)

GRYLLIDES, Latreille.

TRIDACTYLUS, OLIVIER.

The fact that this name is inapplicable in its significance to some of the species contained in it, is no valid reason for its disuse; and even should it be so considered, the name *Heteropus* proposed as early as 1805 by Palisot de Beauvais, must supersede that of *Xya*, so commonly in use, which was not proposed till four years later. If, however, the species having but two of the slender appendages at the termination of the posterior tibiæ should be found to differ generically from those having three, *Tridactylus* would have to be retained for the latter, with *Heteropus* as a synonym; and *Xya* should be applied to the former. That this may yet be found to be the truth, is indicated still further by the fact that the three-fingered species found in this country have a peculiar conformation of the anterior tibiæ, which, however, is a feature of the structure of the male alone, — a fact for which I am indebted to the scrutiny and kind communication of Mr. Uhler; this peculiarity is a lateral projection of an aduncate appendage inwards at the base, to the extremity of which, beside the hook, the tarsi are attached. As a figure will explain much better than any description I can give the form of these parts, I have drawn the anterior tibiæ and tarsi of *T. apicalis*, Say ♂. In the two species (*T. apicalis*, Say, and *T. terminalis*, Uhl.) which show this character, a further difference is to be seen between the males and females, in the more



Fig. 1. swollen prothorax of the former.



1. *T. APICALIS*, Say, Journ. Acad. Nat. Sc. Phil.;  
IV. 310. (Fig. 1.) (1825.)

*T. apicalis*, Say, Ent. of N. Am. (ed. Le Conte);  
II. 239. (1859.)

*Xya apicalis*, Burm., Handb. d. Ent.; II. 742. (1838.)

This is our largest species, the length of the body being fully one third of an inch in both sexes, and of a lighter color than the other species. I suspect that Say had specimens both of this and *T. terminalis*, Uhl., and confounded them together; his description applies best to this, while he endeavored to include them both when he said, "length, more than one fifth of an inch."

Alabama, Prof. Hentz, (H. Coll.) Kentucky, Mr. J. P. Wild, (Uhler.) 2 ♂, 1 ♀.

\* 2. *T. TERMINALIS*, Uhler Mss.

This species is darker than *T. apicalis*, the head and thorax being sometimes pitchy black, at others showing upon these parts reddish brown spots similarly disposed to those upon *T. apicalis*; — the two broad transverse fasciæ and the terminal spot upon the outside of posterior femora, which are only faintly indicated in *T. apicalis*, are here black and very distinct; the wings reach only the tip of the abdomen, while in the males of *T. apicalis* they extend considerably beyond it; it is a much smaller species than the preceding, and occupies a more northern area. Length from .25 to .30 inches.

Cambridge, Mass., May 20, (H. Coll.) Maryland, (Uhler.) So. Illinois, (Thomas, Uhler.) 1 ♂, 6 ♀.

3. *T. MINUTUS*, nov. sp.

This species resembles *T. terminalis* very much in its markings and coloration; but it is in general darker, and the markings are more distinct. The middle femora and tibiæ, and the posterior femora are very dark with narrow white bands, sometimes broken; the segments of the abdomen are bordered with white posteriorly; the wings in the only

mature individual I have seen extend a little beyond the extremity of the abdomen. There are but two terminal appendages of the posterior tibiæ; the males want the aduncate lateral appendage of the anterior tibiæ. Length, .14 to .16 inches.

So. Illinois, (Thomas, Uhler.) 4 ♂.

GRYLLOTALPA, LATREILLE.

*Curtilla*, Oken, Lehrbuch d. Naturgesch.; III. I. 445  
(1815.)

\* 1. *G. BOREALIS*, Burm., Handb. d. Ent.; II. 740.  
(1838.)

*G. brevipennis*, Serv., Hist. Nat. d. Orth.; 308. (1839.)

" " Harr., Report, 3d ed.; 149, fig. 68.  
(1862.)

*G. Americana*, Say Mss., and Harr., Cat. Ins. Mass.;  
56. (1835.)

"Sides of pond, burrowing in moist earth, June, July, Sept." — H.

Mass., (H. Coll., Sanborn.) Island of Nantucket, (Mus. Comp. Zoöl.) Vermont, (Mus. Comp. Zoöl.)

\* 2. *G. LONGIPENNIS*, nov. sp.

Figured in Catesby, Nat. Hist. N. Car.; I. pl. 8.

This species does not differ in any respect from *G. borealis*, save in the greater size and comparatively greater breadth of the wing-covers, which cover rather more than half the abdomen, and in the much greater length of the wings, which extend considerably beyond the extremity of the abdomen; there is a very slight difference in some of the prominences of the anterior trochanters; in coloration and general proportions and absolute size it does not differ from the preceding; it has much the general appearance of *G. hexadactyla*, Perty, from which it differs in being somewhat stouter, in having the teeth of the anterior tarsi long and slender, and in that the ocelli are oval and not subrotund. Length, 1.33 inches.

Mass., (H. Coll.) Maryland, (Uhler.) 2 specimens.

GRYLLUS, LINNÆUS.

- \* 1. *G. LUCTUOSUS*, Serv., Hist. Nat. d. Orthop.; 335.  
(1839.)

This species is readily distinguished from all other N. England species, by the great length of the wings, which, surpassing in length the wing-covers, hang over the extremity of the abdomen; contrary to the supposition of Serville, this is true of the male as well as of the female.

Length of ovipositor in seven individuals, .29-.39 in., average .35 in., length of hind femora, .20-.245 in., average, .225 in.

Mass., (Agassiz, Shurtleff, S. H. S.) Cape Cod, (Sanborn.) N. Hampshire, (Miss Edmands.)

- \* 2. *G. ABBREVIATUS*, Serv., Hist. Nat. d. Orth.; 336.  
(1839.)

*Acheta tripunctata*, Harr., Cat. Ins. Mass.; 56. (1835.)

*Acheta abbreviata*, Harr., Report, 3d ed.; 152. fig. 69.  
(1862.)

This and *G. luctuosus*, Serv. are our largest species; it is remarkable for the great length of the ovipositor of the female; the wing-covers are generally dark, bordered with light brown, though sometimes they are quite pale throughout; they generally quite cover the abdomen. I have never seen this species north of Cape Cod, and am inclined to think it a more southern form, the insect fauna of Cape Cod being closely allied in character to that of Pennsylvania.

Length of ovipositor in seventeen individuals, .34-.42 in., average, .37 in.; length of hind femora, .21-.23 in., average .22 in.

Mass., (H. Coll., Agassiz.) Cape Cod, (Sanborn, S. H. S.) Maryland, (Uhler.) The specimen marked *A. abbreviata* ♂ in Harris's collection belongs to his *A. nigra*.

- \* 3. *G. ANGUSTUS*, nov. sp.

This species is most closely allied to *G. abbreviatus*,



Serv., but differs from it very distinguishably in its much greater slenderness; in the relative proportions of the length of hind femora and ovipositor of the females, it agrees with *G. abbreviatus*, but the latter is a heavy, clumsy species; in *G. abbreviatus* the breadth of the body is contained in the length about three times; in *G. angustus* about four times; in coloration it does not differ from *G. abbreviatus*; it seems to be quite a rare species.

Length of ovipositor .30-.34 in., average, .32 in.; length of hind femora, .18-.20 in., average, .19 in.

Cambridge, Mass., and Cape Cod, (S. H. S.) 3 ♀.

\* 4. *G. NEGLECTUS*, nov. sp.

This is our most common species, and probably the one which Harris intended to describe in mentioning *G. nigra*, but the specimens in his cabinet marked "unique" show his *nigra* to be another species. The head, thorax, and body, as well as the hind femora, are pitchy black, the elytra of both ♂ and ♀ are dark, sometimes jet black, but frequently of quite a light ochraceous brown; indeed, the elytra of almost all our species vary to this extent in coloration; the elytra of the females generally cover about two thirds of the abdomen, although sometimes they entirely conceal it; those of the males extend to the extremity of the abdomen; the ovipositor in this species is proportionally shorter than in either of the preceding species, and is also a smaller species than any of the preceding.

Length averaging a little more than half an inch; length of ovipositor in nine individuals .23-.32 in., average .28 in.; length of hind femora, .16-.21 in., average, .20 in.

Mass., (Mus. Comp. Zoöl., Miss Edmands, Sanborn, S. H. S.) Cape Cod, (Sanborn, S. H. S.)

\* 5. *G. NIGER*.

*Acheta nigra*, Harr., Report, 3d ed.; 152. (1862.)

This species agrees in size with *G. neglectus*, but differs from it in the much shorter ovipositor, which is shorter in



this species than in any other. A single female is the only remaining type of Harris's *nigra*. The specimen marked *A. abbreviata* ♂ in the Harris collection, is a ♂ of this species; it does not differ materially from *G. neglectus* in coloration, being generally not so dark, with more or less reddish hind femora, while it has the wing-covers somewhat longer than there; it seems to be our rarest species.

Length of ovipositor in two individuals, .23–.26 in., average, .245 in.; length of hind femora, .21–.23 in., average .22 in. 2 ♂, 2 ♀.

Mass., (H. Coll., S. H. S.)

Neither of these two latter species can be referred to *G. Pennsylvanicus*, Burm., which I have received from Maryland through Mr. Uhler. *G. Pennsylvanicus* agrees with *G. nigra* in the length of the ovipositor of the female, but it differs from it in the shortness and form of the wing-covers, as well as in their color and that of the legs, in which characters it agrees well with *G. neglectus*, with which it cannot be associated on account of the shortness of the ovipositor. I have another species, smaller than any here mentioned, which I took in Minnesota, which has a very long ovipositor, and also some quite peculiar forms from southern Illinois, received from Mr. Thomas, but I reserve their description till the reception of more specimens. The males of all these species are very difficult to distinguish; indeed, it cannot be done satisfactorily without a large number of specimens; — the study of this genus is certainly a very perplexing one.

NEMOBIUS, SERVILE.

# 1. *N. EXIGUUS*.

*Acheta exigua*, Say, Journ. Ac. Nat. Sc. Phil.; IV. 309.  
(1825.)

“ “ Say, Ent. of N. America (Ed. Le Conte); I. 238.  
(1859.)

St. Louis, Missouri, (S. H. S.) Minnesota, (S. H. S.)

\* 2. *N. vittatus*, Harr., Report, 3d ed.; 152. (1862.)

*Acheta servilis*, Say Mss., and Harr., Cat. Ins. Mass.;  
56. (1835.)

This species differs from the preceding in being of a darker color, and in having the hind femora somewhat ferruginous, besides that the wing-covers differ somewhat in their markings.

Mass., (H. Coll., Miss Edmands, Sanborn, S. H. S.)

Maine, (Packard.) Conn., (S. H. S.)

\* 3. *N. fasciatus*.

*Gryllus fasciatus*, De Geer, Mem.; III. 522, pl. 43,  
fig. 5. (1773.)

*Acheta hospes*, Fabr., Syst. Ent.; 281. (1775.)

" " Fabr., Spec. Ins.; I. 355. (1781.)

" " Fabr., Mant. Ins.; I. 232. (1787.)

" " Fabr., Ent. Syst.; II. 32. (1793.)

*Gryllus hospes*, Oliv., Enc. Meth.; IV. 636. (1791.)

This species, except in the length of wings and wing-covers, is very similar to *N. exiguus*; it is somewhat larger, and has the terminal half of the last joint of maxillary palpi, black; the elytra in both sexes are light brown, with the veins darker, especially in the female, and extending to the extremity of the body; the wings in both sexes are as long again as the body, and the ovipositor of the female is so long as nearly to reach their tip. Length of ovipositor, .25 in. 4 specimens.

Mass., (Shurtleff, "flying against windows at night. Aug. 14.") Delphi, Indiana, (Mus. Comp. Zoöl.) Charleston, S. C., (Mus. Comp. Zoöl.)

I have but little doubt that this species is identical with De Geer's *G. fasciatus*, notwithstanding the somewhat greater size of his figure. But if I have been mistaken in this reference, I shall not have committed so grievous an error as Dr. Fitch has done (3d Report on Noxious Ins. of

N. Y. 132), in referring it to the genus *Æcanthus*, blaming Harris for a mistake never made by him, (see below, under *Æcanthus niveus*, p. 432,) who, he says, "was evidently unacquainted with the work of De Geer and the characters he assigns to these insects, or he would have been aware of his error, the marks by which this species is distinguished being so plain, and so explicitly stated by that author." How was it possible for so acute an observer as Dr. Fitch to overlook the close resemblance between De Geer's figure (save in the length of the wings), and our common *Nemobius vittatus*, Harr., and refer the species to *Æcanthus*, especially when *Æcanthi* of the same sex are figured upon the same plate! Moreover, is it not "explicitly stated by that author," in his description of *G. fasciatus*, that the posterior femora are stout and very wide, that the tibiæ of the same pair have long spines, and that the head and thorax are more hairy than ordinarily? Are these characters of *Æcanthus*, or of *Nemobius* and *Gryllus*? Burmeister has already intimated that the relations of this very species are with *Gryllus* rather than with *Æcanthus*. (Burm., Handb. II. 733.)

ÆCANTHUS, SERVILLE.

- \* 1. *Æ. NIVEUS*, Serv., Ann. Sc. Nat.; XXII. 135. (1831.)
- Æcanthus niveus*, Serv., Hist. Nat. d. Orth.; 361. (1839.)
- “ “ Harr., Cat. Ins. Mass.; 56. (1835.)
- “ “ Harr., Report, 3d ed.; 154, figs. 71,  
72. (1862.)
- “ “ Fitch, 3d Report, Noxious Ins. N. Y.;  
131. (1856.)
- Gryllus niveus*, De Geer, Mem.; III. 522, pl. 43, fig. 6.  
(1773.)
- “ “ Oliv., Enc. Meth.; IV. 637. (1791.)
- Æcanthus cylindricus*, Say Mss., and Harr., Cat. Ins.  
Mass.; 56. (1835.)



*Ecanthus fasciatus*, Fitch, 3d Report, Noxious Ins. N. Y.; 132 (omitting reference). (1856.)

Not only do individuals of this species differ from one another, as Fitch mentions in his distinctions between *Æ. niveus* and *Æ. fasciatus*, but even to a much greater extent, some males having three branches of the "fiddle-bow," and some even five, while they take their origin and termination at very different points in different individuals, and vary besides very much in coloration, many individuals being met with of quite a dark color, especially upon the abdomen and legs. These all belong, however, to one species, no differences being discoverable upon which true natural groups can be founded; nor are there any such concomitant characters among them as Fitch asserts; neither did Harris make any such blunder as to have misunderstood the sexes in this genus as is alleged by him. It would be strange indeed if an entomologist were not acquainted with the very apparent differences existing between them in the prolonged ovipositor of the female, and peculiar structure of the wing-covers in the male.

Mass., (H. Coll., Miss Edmands, Sanborn, Shurtleff, S. H. S.) Conn., (Norton, S. H. S.)

I have never met with *Gryllus bipunctatus*, De Geer, which Fitch refers to under the name of *Æ. punctulatus*. (3d Rep. 133).

#### LOCUSTARIÆ, Latreille.

In a paper on the genus *Raphidophora*, (Proc. Bost. Soc. Nat. Hist.; VIII. 6,) I enumerated the known species inhabiting the United States, amounting in all to three, and added to them descriptions of four others. Since then I have had an opportunity of examining many other species from various parts of the country, through the kindness of Mr. Uhler, and have made a study of others in the Museum of Comparative Zoölogy, so that the number of species is found to be very considerable, and to



form quite a distinct feature of the North American Orthopteran fauna. I was able to show there that *R. xanthostoma*, Scudd. should not be united in the same genus with the others, and that *R. subterranea*, Scudd. had features in its structure which lacked conformity with those possessed by other members of the genus. A closer and more extended study has convinced me that there are here three well-marked genera, and that no one of them can properly be referred to *Rhaphidophora*. *Ceuthophilus* may be applied to the more abundant forms, living in concealment under stones, with which must be associated *R. stygia*, Scudd., found in the shallow Hickman's Cave; of this genus I am acquainted with no less than twelve species, besides one which I have not seen, *Phal. scabripes*, Hald., undoubtedly belonging here. Under the genus *Hadenæcus* we may place *R. subterranea*, Scudd., restricted to the deep caves of Kentucky, while *Tropidischia* is proposed for the genus under which *R. xanthostoma*, Scudd. of California should be placed.

CEUTHOPHILUS, Nov. gen. (κεῦθος, φίλος).

Head rather large, oval; antennæ long, slender, cylindrical; first joint as broad as long, larger and stouter than the rest, which are about equal in thickness, gradually tapering to the extremity; second quite short; third longest; the remainder unequal. Eyes subpyriform, subglobose, crowded against the first swollen joint of antennæ. Maxillary palpi long and slender; first two joints equal, smallest; third fully equal in length to first and second together; fourth three-fourths as long as third; fifth nearly as long as third and fourth together, somewhat curved, swollen towards extremity, split on the under side almost its entire length. Sides of the thoracic nota broad, mostly concealing the epimera; wings wanting; legs rather long; coxæ carinated externally, the third pair but slightly, the

first pair having the carina elevated into a sharp, the second into a dull, point at the middle; first two pair of femora mostly wanting spines; hind femora thick and heavy, turned inward at the base, channelled beneath. Ovipositor generally rather long, nearly straight, but a little concave above, rounded off somewhat abruptly at the extremity to the sharp, upturned point.

This genus differs from *Rhapidophora* in the much shorter legs, in the comparative length of the joints of the maxillary palpi, in wanting the terminal spines of the first two pair of femora, and the unusual development of the terminal spines of posterior tibiæ, as also those upon the first tarsal joints, in the non-compressed joints of the tarsi, and the shortness of the cerci.

\* 1. C. MACULATUS.

*Ephippigera maculata*, Say Mss., and Harr. Cat. Ins. Mass.; 56. (1835.)

*Rhapidophora maculata*, Harr., Report, 1st ed.; 126. (1841.)

*Phalangopsis maculata*, Harr., Report, 3d ed.; 155, fig. 73. (1862.)

*Phalangopsis lapidicola*, Burm., teste Erichson, Archiv. f. Nat.; 9.227, (see No. 3.) (1843.)

*Rhapidophora lapidicola*, (pars) Scudd., Proc. Bost. Soc. Nat. Hist.; VIII. 7. (1861.)

(Not *Phalangopsis lapidicola*, Burm.)

This species has the posterior tibiæ of the male waved at the base in mature individuals, — which is true of this species only.

Mass., (H. Coll., Agassiz, Shurtleff, Sanborn, S. H. S.) Vermont, (Mus. Comp. Zoöl.) Norway, Maine, (Verrill.) Cape Elizabeth, Maine, (Morse.) Anticosti, Gulf of St. Lawrence, (Verrill.)

\* 2. C. BREVIPES, nov. sp.

A species very closely allied to the preceding, but of a

smaller size, and differing from it in its markings and proportions. It is of a pale, dull, brown color, very profusely spotted with dirty white spots, not so large or so frequently confluent as in *C. maculatus*, except near the extremity of the hind femora, where they nearly form an annulation. The mottling of the pronotum is somewhat different than in *C. maculatus*; the hind legs are proportionably shorter, as is also the ovipositor, the spines of whose inner valves are duller.

Length scarcely more than half an inch; average length of hind femora, .44 inch; average length of ovipositor, .25 inch; 2 ♂ 6 ♀.

Grand Manan Is., Maine, (Verrill.)

### 3. *C. LAPIDICOLUS*.

*Phalangopsis lapidicola*, Burm., Handb. d. Ent.; II. 723.  
(1838.)

*Raphidophora lapidicola*, Burm., Germ. Zeitsch. f. Ent.;  
II. 72. (1840.)

“ “ (pars) Scudd., Proc. Bost. Soc.  
Nat. Hist.; VIII. 7. (1861.)

This species is very closely allied to *C. maculatus*, differing from it in style of mottling of the upper surface, and in that the males do not have the posterior tibiæ waved. Since there are two species, (this and the following,) which both correspond to the description of Burmeister's *lapidicola*, I have chosen to apply his name to that one, of which a specimen is to be found in the Cambridge Museum, labelled thus by Mr. Haldeman some years since. I had not seen it or any southern species previous to the publication of my paper on *Raphidophora*.  
4 ♂ 3 ♀.

Maryland, (Uhler.) Pennsylvania, (Mus. Comp. Zoöl.)  
Georgia, (Mus. Comp. Zoöl.)

### 4. *C. UHLERI*, nov. sp.

This species also is closely allied to all the preceding,



but especially to *C. lapidicolus*, from which, however, it differs in its markings more than *C. lapidicolus* does from *C. maculatus*. The ground-color is reddish brown, and the spots which make up the mottling are distributed more regularly than in the preceding. It differs from it further in the greater length of the antennæ, and in the presence of spines upon the under side of the hind femora; these are spined both upon the inner and outer edge, those of the inner edge being minute, regularly arranged, and of equal size, while those of the outer edge to the number of 5-8 only, are much larger, longer, of unequal length, and irregularly arranged. As the only female I have seen wants the hind femora, I cannot tell whether the males and females differ in the character of these spines as is the case in some species. The hind legs of this species are proportionally longer than in any previously mentioned.

Average length of body .65 inches; average length hind femora .70 inches; length of antennæ about  $1\frac{1}{2}$  inches; length of ovipositor .35. 3 ♂ 1 ♀.

Maryland, (Uhler.)

5. *C. SCABRIPES*.

*Phalangopsis scabripes*, Hald., Proc. Ac. Nat. Sc. Phil.;  
VI. 364. (1853.)

*Raphidophora scabripes*, Scudd., Proc. Bost. Soc. Nat.  
Hist.; VIII. 7. (1861.)

This is the only described species of the genus which I have not seen. The darker portions of the hind femora of all the species have scabrous surfaces.

Alabama, (teste Haldeman.)

6. *C. DIVERGENS*, nov. sp.

A species recalling *C. lapidicola* by its coloration and markings, which in general appearance it much resembles, but from which, as from all others I know, it may be distinguished by the peculiar disposition of the spines upon the posterior tibiæ, which, in addition to the row of min-



ute crowded spines directed downward which all have upon either edge of the under-side, have also five spines of a peculiar character placed in each of these rows; they are quite long, placed at regular distances from one another, from the tip of the tibiæ to near its base, those upon either row alternating with one another, and directed in almost exactly opposite directions; they do not point backwards at the same angle with the others, but are turned outwards nearly at right angles to the tibiæ; the tibiæ of the other legs also partake of this character to some extent; —in this species the spines of the posterior femora are altogether wanting in the female, while the male has spines similar to those of *C. Uhleri*. Antennæ quite long; hind femora in male stouter than in female.

Length of body, .45-.60 in.; hind femora, .25-.30 in.; antennæ, 1.5-2 inches. 1 ♂ 2 ♀.

Nebraska, (Mus. Comp. Zoöl.)

7. *C. LATENS*, nov. sp.

Pale yellowish brown, with darker streaks upon the hind femora and two broad bands of dark reddish brown along the whole dorsum, extending half-way down the sides, dotted irregularly with brownish yellow spots most profusely on the abdomen, and separated from one another by a narrow, irregular band of the same color; head above, reddish brown; below, yellowish brown; tips of the femora dark; no spines upon the under-side of the hind femora. The hind femora are thick and stout, and the whole hind leg shorter than in most of the species. The ovipositor is shorter than usual in this species, though not nearly so short as in *C. californianus*.

Length of body, .65 in.; of hind femora, .5 in.; of ovipositor, .27 in. 1 ♀ (antennæ broken).

Illinois, (Uhler.)

8. *C. NIGER*, nov. sp.

Most nearly allied to *C. latens* by the shortness of the

hind-legs and of the ovipositor. It is, however, wholly of a black color with a reddish tinge, especially about the head, under-surface of body, hind femora, and ovipositor; the spines of the legs are all reddish brown; there are also some traces of a reddish tinge upon the pronotum, which thus exhibit obsolete vestiges of the peculiar markings of the *Ceuthophili* hitherto mentioned; the hind femora are unusually slender though short; the claws of all the feet are twice as long as ordinarily, and the denticulations of the inner valves of the ovipositor are very slender and long; the antennæ are quite short; the eyes are more nearly circular and more globose than usual, and do not hug the base of the antennæ so closely.

Length of body, .6 in.; of hind femora, .4 in.; of ovipositor, .27; of antennæ, 1 in. 1 ♀.

Rock Island, Illinois, (Uhler.)

9. *C. CALIFORNIANUS*, NOV. SP.

Fuscous, paler beneath and upon the front of the head; a narrow pale median line; eyes black; palpi pale; antennæ light brown. The hind femora are short and thick, and have no spines upon the under-surface; the claws of all the tarsi are quite long; the ovipositor is remarkably short, no longer than the cerci; the denticulations of the inner valves are rather prominent but dull.

Length of body, .53 in.; of hind femora, .22 in.; of ovipositor, .09 in. 1 ♀.

San Francisco, Cal. (Mus. Comp. Zoöl.)

I have a species from Texas, apparently more closely allied to this than to any other, though with an ovipositor of ordinary length, but in too mutilated a condition for description.

10. *C. STYGIUS*.

*Raphidophora stygia*, Scudd., Proc. Bost. Soc. Nat. Hist.;  
VIII. 9. (1861.)

Hickman's Cave, Kentucky, (Hyatt.)

11. *C. AGASSIZII.*

*Raphidophora Agassizii*, Scudd., Proc. Bost. Soc. Nat. Hist.; VIII. 11. (1861).

Gulf of Georgia, Washington Territory, (A. Agassiz.)

12. *C. GRACILIPES.*

*Phalangopsis gracilipes*, Hald., Proc. Am. Ass. Adv. Sc.; II. 346. (1850.)

*Raphidophora gracilipes*, Scudd., Proc. Bost. Soc. Nat. Hist.; VIII. 7. (1861.)

This has longer legs than any other species, unless it be *C. stygia*, which it much resembles in style of marking and length of antennæ; this, together with the two preceding species, frequently have little suppressed spines upon the inner edge of the upper posterior half of the hind femora.

S. Illinois, (Uhler.) N. York, (Uhler.) Schooley's Mt., New Jersey, (Mus. Comp. Zoöl.) 3 ♂.

The first eight species of *Ceuthophilus* mentioned agree together remarkably in the distribution of the markings of the dorsum, as do also the three last among themselves, while *C. californianus* and the undescribed Texan species form a third distinct group.

HADENÆCUS, Nov. gen. (ἡδῆς, ἐνοικος).

Body small and slender; head similar to *Ceuthophilus*; antennæ, very long and slender, exceeding the length of the body many times; basal joints much as in *Ceuthophilus*, except that the second is broader, and the fourth is more than half the length of the third; eyes as in *Ceuthophilus*; maxillary palpi very long and slender; first joint short; second fully twice as long as first; third quite long, fully equalling twice the length of second; fourth nearly as long as the third, slender at the base, thickened towards the tip; fifth, longer than third, of a similar form to the fourth, but more incrassated at the tip, compressed lat-



erally, slightly curved, and split on the underside only at the tip. Tubercle of the vertex very small, pointed, bilobed. Epimera of the meso- and metathorax not covered by the sides of the meso- and metanotum; wings wanting; metasternum with a short sharp spine; legs remarkably long and slender; coxæ carinated externally, the first pair having the carina elevated in the middle to a point; femora without spines; hind femora turned inwards and a little swollen at the base, extending over only the basal half; under-surface delicately channelled; the two anterior tibiæ are slightly longer than their corresponding femora; tarsi much compressed laterally; anal cerci long and slender; ovipositor long and slightly ensiform, rounded off very gradually at the extremity to a delicate point.

This genus differs from *Rhaphidophora* in the proportional lengths of the joints of the maxillary palpi, in the want of spines on the first two pair of femora, and the peculiarity of character in those of the posterior tibiæ and basal tarsal joint, as well as the shape of the latter, in the convexity of the eyes, and in the non-development of spines on the coxæ of the mesothoracic legs; most probably *Raphid. palpata*, Charp., of Europe, belongs to this genus.

#### 1. H. SUBTERRANEA.

*Rhaphidophora subterranea*. Scudd., Proc. Bost. Soc. Nat. Hist.; VIII. 8. (1861.)

Mammoth Cave, Kentucky, (Hyatt, D. C. Scudder.)

TROPIDISCHIA, Nov. gen. (τρόπις, ισχία).

Head similar to *Ceuthophilus*; antennæ long and slender, about three times the length of the body; first joint large and stout, considerably longer than broad; second much smaller but broader than the succeeding; third long and slender, narrowing anteriorly, the rest unequal; eyes subovate, very globose, slightly removed from the basal



joint of antennæ; maxillary palpi, long and slender; first and second joints short, the second a little the longer; third more than twice the length of the second; fourth nearly as long as third; fifth nearly equal to third and fourth together, a very little curved, swollen at the tip, and split a little way down the under-side; tubercle of the vertex small, but sharply prominent, deeply bisected; sides of the thoracic nota shorter than in *Hadenæcus*, the meso- and metanotum not extending downwards so far as the pronotum; wings wanting; legs long and slender, especially the hindmost pair; the coxæ have the lower edge produced on the inner side to a small dull spine, and they are also carinated externally, the carinæ of the pro- and mesothorax being produced to a spine as in *Ceuthophilus*; the femora and tibiæ are four-sided, and have all the edges minutely and closely spined, except the posterior femora; these are swollen, though not heavily, at the basal portion, which is not turned inwards, as in the two preceding genera, and has the rectangular spinous character of the other femora upon the terminal half, and even affecting the swollen portion; the under-surface is deeply and narrowly channelled; the two anterior tibiæ are somewhat longer than their corresponding femora; there are no heavy spines upon any portion of the legs except upon the extremity of the hind tibiæ where there is a pair of moderately long ones; tarsi much compressed laterally; anal cerci blunt, channelled interiorly.

This genus differs from *Raphidophora* in the character of its maxillary palpi, the absence of any peculiar development of spines upon the legs, in the shape of the joints of the tarsi, and the globosity of the eyes.

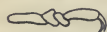
1. T. XANTHOSTOMA.

*Raphidophora xanthostoma*, Scudd., Proc. Bost. Soc. Nat. Hist.; VIII. 12. (1861.)

Crescent City, Cal. (A. Agassiz.)

UDEOPSYLLA, Nov. gen. (οὐδοας, ψύλλα).

This genus is to be placed between *Ceuthophilus* and *Daihinia*. The body is heavier and stouter than in *Ceuthophilus*, with a larger head; the form of the body is that of *Ceuthophilus*; antennæ as in *Daihinia*; first joint larger and stouter than the rest, as broad as long, compressed anteriorly; third joint twice as long as second; remainder unequal; eyes small, subpyriform, docked on the antennal border, globose; maxillary palpi rather long; first and second joints equal and small; third, more than equal to the preceding together; fourth, little more than half as long as third; fifth, a little longer than third, somewhat curved, split along the whole under side; as in *Ceuthophilus* the pro- meso- and metanota nearly conceal the epimera of the thoracic segments; coxæ differing but slightly from *Ceuthophilus*; hind femora very heavy, thick, and especially broad, but not so much so as in *Daihinia*, where, as in this genus, the whole limb is swollen, and not the basal portion only, as in the preceding genera; in the males the hind femora are spined beneath; the fore and middle femora are shorter and heavier here and in *Daihinia* than in *Ceuthophilus*; tarsi, with the first and fourth joints equal and longest; second and third equal and small, the second overlapping the third above;



the ovipositor is rather short, thick at base, slender at apical half, terminating much as in *Ceuthophilus*.

This genus differs from *Daihinia* in the longer, more slender, less robust, and less spinous legs, in the somewhat more slender body and smaller head, in the shorter maxillary palpi, and in the structure of the tarsal joints. See figs. 2, 3.

1. U. ROBUSTA.

*Phalangopsis (Daihinia) robustus*, Hald., Proc. Am. Ass. Adv. Sc.; II. 346. (1850.)

Platte River above Fort Laramie, Nebraska, (Mus. Comp. Zoöl.) 2 ♂ 2 ♀.

I have examined Haldeman's types.

2. *U. NIGRA*, nov. sp. (Fig. 2.)

Shining black, with a faintly indicated, narrow, reddish dorsal line, a reddish tinge on the front of the face, the basal half of the inner surface of hind femora and the terminal half of the ovipositor, reddish. The hind femora of the male have, upon either edge of the under-surface, but especially on the inner, short but heavy spines, not crowded; the hind tibiae are furnished on either edge of the upper surface with four or five opposite, long, and slender spines, between each two of which are placed three or four suppressed spines; there is a single row of short spines upon the under-surface, which become double towards the tip; the inner valves of the ovipositor have five teeth, growing longer and more curved towards the tip, where they are very long and slender.

Length of body, .8-.9 in.; of hind femora ♀ .56 in.; ♂ .68 in.; of ovipositor, .33 in.; of antennæ, about an inch. 1 ♂ 1 ♀.

Red River of the North, (Kennicott.) Minnesota, (S. H. S.)

DAIHINIA, HALDEMAN.

In this genus, while the tarsi of the mesothoracic legs are as they appear in allied genera, *the tarsal joints of the anterior and posterior pair are only three in number*, the first and last being of nearly equal <sup>a</sup> length, with a *single* small joint between them, a very interesting exception to the almost universal rule among the *Locustariæ*. (See Fig. 3, <sup>b</sup> Fig. 3. a. b.)

1. *D. BREVIPES*, Hald., Proc. Am. Ass. Adv. Sc.; II. 346. (Fig. 3.) (1850.)

*D. brevipes*, Girard, Orthop. in Marcy's Expl. Red River of Louisiana; 246. Zoöl. Pl. XV. figs. 9-13, (1854.)

Platte River above Fort Laramie, Nebraska, (Mus. Comp. Zoöl.) 2 ♂, 1 ♀.

I have examined Haldeman's types.

CYRTOPHYLLUS, BURMEISTER.

\* 1. C. CONCAVUS.

*Pterophylla concava*, Say Mss. and Harr., Enc. Am.;  
VIII. 42. (1831.)

" " Harr., Cat. Ins. Mass.; 56. (1835.)

*Platyphyllum concavum*, Harr., Report, 3d ed.; 158, fig.  
74. (1862.)

*Platyphyllum perspicillatum*, Serv. teste Erichson, Archiv.  
f. Nat.; IX. 227. (see No. 2.) (1843.)

" " Uhl. in Harr., Report, 3d  
ed.; 158. (1862.)

(Not *Locusta perspicillata*, Fabr.)

Mass., (H. Coll., Agassiz.) Conn., (Norton.) N. Y.,  
(Edwards, Akhurst.)

2. C. PERSPICILLATUS, Burm., Handb. d. Ent.; II. 697.  
(1838.)

*Locusta perspicillata*, Fabr., Spec. Ins.; I. 357. (1781.)

" " Fabr., Mant. Ins.; I. 233. (1787.)

" " Fabr., Ent. Syst.; II. 36. (1793.)

" " Stoll, Spectres, etc.; Pl. VII. a. fig.  
23. (1813.)

*Platyphyllum perspicillatum*, Serv., Hist. Nat. d. Orth.;  
445. (1839.)

This species differs from the northern one in its shorter,  
but equally broad wing covers, in the slightly broader so-  
norous apparatus of the male, and in the more robust legs.

1 ♂.

Texas, (Mus. Comp. Zoöl.)

PHYLLOPTERA, SERVILLE.

\* 1. P. OBLONGIFOLIA, Burm., Handb. d. Ent.; II. 693.  
(1838.)



*Locusta oblongifolia*, De Geer, Mem.; III. 445. Pl.  
38, fig. 2. (1773.)

*Gryllus oblongifolius*, Harr., Cat. Ins. Mass.; 56. (1835.)

*Phylloptera oblongifolia*, Harr., Report, 3d ed.; 159.  
(omitting figure) (1862.)

Mass., (H. Coll., Agassiz, S. H. S.) 3 ♂, 2 ♀.

\* 2. *P. ROTUNDIFOLIA*, nov. sp. (Fig. 4), figured as *P. oblongifolia*, Harris' Report, 3d ed., fig. 75.

This species agrees with the preceding in coloration in every respect, unless the color of the ovipositor of the female be different in fresh specimens. The wings and wing-covers are much shorter than in *P. oblongifolia*, the wing-covers, in consequence, being more ovoid. It differs from that species, also, in the shape of the prothorax, which, in *P. oblongifolia*, is much narrower at the anterior than at the posterior border, and has the angle formed by the deflexion of the sides quite sharp, while in *P. rotundifolia* the posterior border is scarcely wider than the anterior, and the angle of the sides is rounded. It is a smaller species than *P. oblongifolia*.

Length of body, .8 in.; of wing covers, 1 in.; of wings, (when closed,) 1.17 in.; of hind femora, .87 in.; of ovipositor, .37 in.

Mass., (Sanborn, Miss Edmands.) Vermont, (Mus. Comp. Zoöl.) Conn., (Norton.) Rhode Island, (H. Coll.) Illinois, (Mus. Comp. Zoöl.)

3. *P. CAUDATA*, nov. sp.

Similar in general appearance to *P. oblongifolia*, but having a larger body, with slightly longer wings, much longer legs, and a very long ovipositor. The prothorax is narrowed anteriorly, as in *P. oblongifolia*, while the lateral angles are rounded as in *P. rotundifolia*. The specimen I have examined is old and discolored, but faint tinges of green are left upon some parts, indicating that the general color was as in the preceding species.

Length of body, 1 in.; of wing covers, 1.5 in.; of wings, (when closed,) 1.8 in.; of hind femora, 1.4 in.; of ovipositor, .8 in. 1 ♀.

Texas, (Mus. Comp. Zoöl.)

MICROCENTRUM, Nov. gen. (μικρὸς, κέντρος).

Head oval, broader and stouter than in *Phylloptera*; tubercle of the vertex somewhat prominent, scarcely broader than first joint of antennæ, slightly furrowed; eyes broadly oval, very prominent; first joint of antennæ as broad as long, second one-third as large but also stout, remainder long and slender, cylindrical. Prothorax flat or very slightly concave above, anterior border very slightly concave, posterior quite convex; the sides nearly parallel, the length but little surpassing the breadth; lateral carinæ quite sharp; lobes of the side straight in front, well rounded and curving forwards behind, rounded beneath, deeper than broad; wing-covers with the triangular superior surface extending backwards farther than in *Phylloptera*, and the wing-covers themselves not regularly rounded as there,



Fig. 4.



Fig. 5.

but with the inner border straighter till near the tip, the outer border sloped off toward the tip, and the tip itself more pointed (see figs. 4 and 5); legs slender, much shorter than in *Phylloptera*, especially the metathoracic; ovipositor very short, strongly curved, and bluntly pointed.

This genus differs from *Phylloptera*, to which it is most nearly allied, especially by the cut of the wing-covers and the shortness of the hind legs and ovipositor.

1. *M. RETINERVIS*.

*Phylloptera retinervis*, Burm., Handb. d. Ent.; II. 692. (1838.)

*Phylloptera curvicauda*, Harr., Report, 3d ed.; 161, note.  
(1862.)

(Not *Locusta curvicauda*, De Geer.)

North Carolina, (H. Coll.) Georgetown, D. C., (Mus. Comp. Zoöl.) 2 ♂.

\*2. *M. AFFILIATUM*, nov. sp. (Fig. 5.)

This species is very closely allied to the preceding, but is a larger insect; the hind femora are proportionally shorter when compared with the wing-covers; the eyes are less prominent than there, and the tubercle of the vertex is slightly broader, with a broader and shorter medial furrow, forming rather a sort of shallow pit. A further distinction is seen in that the slightly hollowed front of the prothorax has a very small central tooth, which does not exist in *M. retinervis*.

Length of wing-covers, 1.75 in.; breadth, .56 in.; of hind femora, .9 in.; of ovipositor, .24 in. 4 ♂, 2 ♀.

Mass., (H. Coll., Miss Edmands.) Maryland, (Uhler.) Key West, (Mus. Comp. Zoöl.) Texas, (Mus. Comp. Zoöl.) Nebraska, (Mus. Comp. Zoöl.)

3. *M. THORACICUM*, nov. sp.

*Locusta maxima viridis alis latissimis*, Sloane., Nat. Hist. Jamaica; II. 201. Pl. 236, figs. 1, 2. (1725.)

Tubercle of the vertex rather prominent, narrow, faintly bilobed and divergent at the apex, with a narrow median groove; eyes as in *M. affiliatum*, but large; prothorax constricted anteriorly, the front border straight; side lobes broader and more amply rounded than in other species; lateral carinæ quite prominent, transversely ridged, raised at the posterior half quite considerably, and pinched where it is highest; hind border not so convex as in the preceding species, and slightly angulated; the top of the prothorax is hollowed, and has a faint medial and transverse furrow; wing-covers very closely and minutely punctured throughout; posterior tibiæ triquetral, expanded upon the upper

surface, with a row of fine spines upon either side, a single row beneath; upper surface flat from tip to quite near the base, where it is suddenly rounded; ovipositor very small, slender, sharply upturned. The only specimen I have seen was preserved in alcohol, but still exhibits a short, median, longitudinal, blood-red streak on the face, and has the posterior third of the lateral carinæ of prothorax, with the whole hind border, edged with black.

Length of wing-cover, 2.2 in.; breadth, .8 in.; length of wings beyond wing-cover, .2 in.; of hind femora, 1.2 in.; of ovipositor, .25 in. 1 ♀.

Tortugas, Florida, (Mus. Comp. Zoöl.)

This species seems closely allied to *Phylloptera azteca*, Sauss.

PHANEROPTERA, SERVILE.

- \* 1. *P. CURVICAUDA*, Serv., Ann. Sc. Nat.; XXII. 159.  
(1831.)

*Phaneroptera curvicauda*, Burm., Handb. d. Ent.; II.  
691. (1838.)

*Locusta curvicauda*, De Geer, Mem.; III. 446. Pl. 38,  
fig. 3. (1773.)

*Gryllus locusta myrtifolius*, Drury, Ill. Ex. Ent.; II. 78.  
Pl. 41, fig. 2. (1773.)

*Gryllus (Phyllopterus) myrtifolius*, Drury, Ill. Ex. Ent.  
(ed: Westw.); II. 88. Pl. 41, fig. 2, (omit-  
ting synonymy.) (1837.)

*Pterophylla curvicauda*, Harr., Cat. Ins. Mass.; 56.  
(1835.)

*Phaneroptera angustifolia*, Harr., Report, 3d ed.; 160.  
fig. 76. (1862.)

This species varies very much in size, and in the proportions of the length of the wing-cover to its breadth. I have seen specimens from Texas which apparently belong to this species.

Mass., (H. Coll., Agassiz, Shurtleff, Sanborn, S. H. S.)



Conn. (Norton.) Maine, (Packard.) Red River Settlements, British Am. (S. H. S.)

CONOCEPHALUS, THUNBERG.

- \* 1. *C. ENSIGER*, Harr., Report, 3d ed.; 163. fig. 79. (1862.)

*C. ensiger*, Harr., Cat. Ins. Mass.; 56. (1835.)

*Locusta acuminata*, Stoll, Spectres; Pl. VIII. a. fig. 27. (1813.)

(Not *Locusta acuminata*, Linn. and De Geer, nor *Locusta acuminata*, Fabr.)

Mass., (H. Coll., Sanborn, Shurtleff.) Cape Cod, (S. H. S.) Vermont, (H. Coll.) Conn., (Norton, S. H. S.) Illinois, (Mus. Comp. Zoöl.) Minnesota, (S. H. S.) Nebraska, (Mus. Comp. Zoöl.)

- \* 2. *C. ROBUSTUS*, nov. sp.

Either pea-green or dirty brown; tubercle of the vertex tipped with black, not extending, or but very faintly and narrowly, down the sides; lateral carinæ of prothorax pale yellowish; wing-covers dotted with irregularly distributed black dots, most conspicuous in the brownish individuals. In form as in coloration, this species is much like *C. ensiger*. The shape of the conical projection of the vertex is the same, or a little stouter; it is a larger species, much broader and stouter than it, the wings broader, and when compared with the hind femora, a little longer than they are in *C. ensiger*; the spines upon the under side of the hind femora are larger than there, being noticed easily with the unassisted eye; the ovipositor of the female is much shorter than in *C. ensiger*, and finally the insect is much broader across the mesothorax, with a heavier sonorous apparatus in the male; wing-covers fully as long as the wings in the male; slightly longer than the wings in the female. The only difference between this species and *C. ensiger* in coloration is the usual lacking of the spots on the wing-cover

in the latter, and in the same the presence of a broad black band on either side of the tubercle of the vertex, which exists in the former but seldom, and then it is very narrow.

♂ Length of wings, 1.7 in.; breadth in middle, .32 in.; of hind femora, .9 in. ♀ Length of wing-covers, 1.9 in.; extent of wing-covers beyond wings, .1 in.; breadth of wing-covers in middle, .22 in.; length of hind femora, 1 in.; of ovipositor, 1 in. 17 ♂ green, 19 ♂ brown, 1 ♀ green.

Cape Cod, by the sea-beach, Sept. (S. H. S.)

This peculiarity of having its individuals either wholly green or wholly brown, extends to *C. ensiger* also, and is found in both while the animals are alive; I have never seen a brown ♀ alive.

3. *C. obtusus*, Burm., Handb. d. Ent.; II. 705. (1838.)

*C. dissimilis*, Serv., Hist. Nat. d. Orth.; 518. (1839.)

" " Harr., Report, 3d ed.; 164. (1862.)

Georgia, (Mus. Comp. Zoöl.) 7 ♀.

4. *C. uncinatus*, Harr., Report, 3d ed.; 164. (1862.)

The legs in this species are much shorter and more robust than in any other American species I have seen. Length of hind femora .65 in. I have seen only Harris's original specimen. 1 ♀.

Alabama, (H. Coll.)

5. *C. crepitans*, nov. sp.

The specimens I have examined were dried after an immersion in alcohol, and are uniform in their coloration throughout, with indications of light yellow lateral streaks on the prothorax, as in *C. robustus*; the tubercle of the vertex is devoid of markings; the shape of the tubercle is very similar to *C. robustus*, but it is stouter than there; head and prothorax punctured throughout, the latter with a faintly impressed median line. This is a large species, broad across the mesothorax as in *C. robustus*, having very long and narrow wings, long and slender legs, and a rather long ovipositor.

Length of body 1.5 in.; of wing-covers ♂ 2 in., ♀ 2.4 in.; breadth in middle ♂ .33 in., ♀ .28 in.; length of hind femora ♂ 1.1 in., ♀ 1.3 in.; of ovipositor 1.43 in.; of tubercle of vertex beyond the eye .12 in., 1 ♂, 2 ♀.

Texas, (Mus. Comp. Zoöl.) Nebraska, (Mus. Comp. Zoöl.)

XIPHIDIUM, SERVILLE.

- \* 1. *X. FASCIATUM*, Serv., Ann. Sc. Nat.; XXII. 159. (1831.)

*Locusta fasciata*, De Geer, Mem.; III. 458. Pl. 40, fig. 4. (1773.)

*Pterophylla fasciata*, Harr., Cat. Ins. Mass.; 56. (1835.)

*Orchelimum gracile*, Harr., Report, 3d ed.; 163. Fig. 78. (1862.)

*Xiphidium fasciatum*, Burm., Handb. d. Ent.; II. 708. (1838.)

Mass., (H. Coll., Shurtleff, Sanborn, Miss Edmands, Agassiz, S. H. S.) Maine, (Packard.) Vermont, (H. Coll.) Rhode Island, (H. Coll.) Conn., (Norton.) Cape Cod, (S. H. S.)

- \* 2. *X. BREVIPENNIS*, nov. sp.

Size of *X. fasciatum*, with which it agrees in coloration throughout, except that the wings are a little darker, the dorsal band is a little broader, and the ovipositor is of a reddish brown throughout, while in *X. fasciatum* it is green at the base; wings .08 in. shorter than the wing-covers; both shorter than the body; ovipositor nearly equalling the hind femora in length. In these respects it differs very much from *X. fasciatum*.

Length of body, .5 inch; of wing-covers, .33 in.; of hind femora, .43 in.; of ovipositor, .4 in.

Mass., (H. Coll., Agassiz, Miss Edmands, Shurtleff, Sanborn, S. H. S.) Cape Cod, (S. H. S.) Maine, (Packard.)

3. *X. ENSIFER*, nov. sp.

Green, with a reddish brown broad central stripe on top

of head and prothorax, narrowed in front, extending to tip of tubercle of vertex; wings very nearly of the same length as the wing-covers, both shorter than body, as in *X. brevipennis*; ovipositor very long, exceeding the length of the hindmost femora, of a brown color, deepest toward apex.

Length of body, .55 in.; of wing-covers, .30 in.; of hind femora, .48 in.; of ovipositor, .6 in. 2 ♀.

Lawn Ridge, Illinois, (Mus. Comp. Zoöl.)

#### ORCHELIMUM, SERVILE.

- \* 1. *O. VULGARE*, Harr., Report, 3d ed.; 162. Fig. 77.  
(1862.)

*Pterophylla agilis*, Harr., Cat. Ins. Mass.; 56. (1835.)  
Mass., (H. Coll., Sanborn, S. H. S.) Cape Cod, (S. H. S.) Conn., (Norton.)

- \* 2. *O. CONCINNUM*, nov. sp.

♂ Brownish green; a dark reddish brown dorsal streak upon the head and prothorax, becoming faint towards the hind border of prothorax, and narrowing anteriorly to the width of the tubercle of the vertex, passing over this down the front to the labrum, expanding broadly in the middle of the face; legs brownish green, tarsi dark brown, spines of tibiæ tipped with black; abdominal appendages reddish brown; wing-covers pellucid, veins grass-green, except the heavy transverse vein of the sonorous apparatus, which is brown; wings pale brownish green, extending a little beyond wing-covers; ♀ having the same markings as the ♂ except that all the nervures of the wing-covers are brown, and the wings are more dusky, and are shorter than the wing-covers; ovipositor reddish brown, a little curved and very pointed; a much slenderer and more graceful form than *O. vulgare*.

Length of body, .7 in.; of wing-covers, .84 in.; of wings beyond wing-covers, .08 in.; of hind femora, .6 in.; of ovipositor, .32 in. 1 ♂, 2 ♀.



Cape Cod, (S. H. S.)

\* 3. *O. GLABERRIMUM.*

*Xiphidium glaberrimum*, Burm., Handb. d. Ent.; II. 707.  
(1838.)

The dorsal band here is bordered with black, as is also the outer edge of the sonorous apparatus of the male; antennæ very long; ovipositor slightly expanded in the middle.

Conn., (Norton.) Georgia, (Gerhard.) 1 ♂, 1 ♀.

4. *O. AGILE.*

*Locusta agilis*, De Geer, Mem.; III. 457. Pl. 40, fig. 3.  
(1773.)

*Xiphidium agile*, Burm., Handb. d. Ent.; II. 707. (1838.)

This species has a short ovipositor, shaped much as in *O. vulgare*, and a very narrow dark median streak down the face; it has a shorter pronotum than *O. vulgare*.

Maryland, (Uhler.) Illinois, (Mus. Comp. Zoöl.) 2 ♀.

5. *O. LONGIPENNIS*, nov. sp.

Dorsal band on head dark reddish brown, broad, narrowing to the width of tubercle of vertex, not extending over the face, divided on the pronotum, forming two narrow bands, scarcely reaching either front or hind border; wing-covers very long and slender, a little shorter than the wings; tarsi with first two joints brown, the other two dark green; ovipositor not long, pointed, reddish brown; antennæ extending back beyond tip of wings.

Length of wing-covers, 1.16 in.; of wings beyond wing-covers, .1 in.; of hind femora, .72 in.; of ovipositor, .32 in.  
1 ♀.

Texas, (Mus. Comp. Zoöl.).

THYREONOTUS, SERVILLE.

\* 1. *T. PACHYMERUS.*

*Decticus pachymerus*, Burm., Handb. d. Ent.; II. 712.  
(1838.)

Conn., (Norton.) Mammoth Cave, Kentucky, (Hyatt.)

1 ♂, 2 ♀.

\* 2. *T. DORSALIS*.

*Decticus dorsalis*, Burm., Handb. d. Ent.; II. 713. (1838.)

Mass., (Sanborn.) Rhode Island, (H. Coll.) Maryland, (Uhler.) 6 ♀.

Among other distinctions between these two species, it may be seen that *T. pachymerus* has the pronotum well rounded behind, while the hind margin of the other is nearly square; and the ovipositor is longer in *T. dorsale* than in *T. pachymerus*, as are also the hind legs.

ACRYDII, Latreille.

OPOMALA, SERVILLE (*emend.*)

\* 1. *O. BRACHYPTERA*, nov. sp.

Above reddish brown, dotted faintly with black, extending a little over the sides; sides dirty yellowish brown, with a faint dark streak extending from lower border of eye backwards over the lower border of pronotum; face dirty yellowish brown, dotted faintly with brownish spots; antennæ brown, darkest toward tip; legs reddish brown, tarsi darker, tibiæ with black tipped spines; hind femora with a row of black dots on upper edge, terminal lobe black; hind tibiæ at base and on under side toward the tip, black; wing covers yellowish brown; vertex of the head rather prominent, suddenly swollen in advance of the eyes, from thence sloping to a blunt rounded point, the edge upturned, and the median ridge prominent and sharp, becoming rounded on the head; wing-covers but little more than half the length of body; wings very short, nearly abortive.

Length of body, 1.05 in.; of antennæ, .46 in.; of vertex .053 in.; of hind femora, .52 in.; of wing-covers, .42 in of wings, .1 in. 1 ♂.

Princeton, Mass. (S. H. S.).

CHLOËALTIS, HARRIS.

*Chrysochraon*, Fisch. Fr.

\* 1. *C. CONSPERSA*, Harr., Report, 3d ed.; 184. (1862.)

*C. abortiva*, " " " " (1862.)

Mass., (Sanborn.) New Hampshire, (H. Coll.) Eastern shore of Lake Winnipeg, British America, (S. H. S.) 5 specimens.

\* 2. *C. VIRIDIS*, nov. sp.

Vertex broad, expanding a little in advance of the eyes, beyond which the sides slope so as to form a right angle with each other, rounded at the apex; the edge upturned more or less; pronotum with the median and lateral carinæ parallel, distinct, sharp; wing-covers shorter than the body, a little longer than the wings.

♂ Top of head and prothorax green; sides of head and prothorax dirty brown, with an horizontal black band behind the eye, extending over prothorax; front of head yellowish brown; fore and hind legs reddish brown, mesothoracic legs green; spines of tibiæ tipped with black; wing-covers above green, upon the sides brown; body beneath yellowish. ♀ varying from olivaceous green to dark brown, with a dark band behind the eye as in the ♂; upon the top of the head a dark band extends from either side of the vertex, curving inwards and then outwards to midway between the median and lateral carinæ; hind tibiæ reddish brown.

Length of body, ♂ .6 in., ♀ 1 in.; of pronotum, ♂ .14 in.; ♀ .21 in.; breadth of pronotum, ♂ .07 in., ♀ .13 in.; length of hind femora, ♂ .4 in.; ♀ .6 in.; of wing-covers, ♂ .3 in., ♀ .42 in. 3 specimens.

Conn., (Norton.)

\* 3. *C. PUNCTULATA*, nov. sp.

Vertex broad, much as in *C. viridis*, but slightly more prominent; sides of the pronotum very nearly parallel, slightly divergent posteriorly; lateral and median carinæ

distinct, sharp; wing-covers extending to tip of abdomen equally with the wings.

Vertex edged with reddish brown; a narrow reddish brown band extends along the lateral carinæ of pronotum to the eye, edged below with black; it extends also slightly upon the base of the wing-covers; abdomen, sternum, forelegs and mouth-parts, (except the black mandibles,) reddish brown; hind tibiæ yellowish brown, its spines tipped with black; all the tarsi darker; wing-covers green, with scattered small brownish spots.

Length of body, .95 in.; of pronotum, .19 in.; width of pronotum in middle, .09 in.; length of hind femora, .54 in.; of wing-covers, .7 in. 1 ♀.

Conn., (Norton.)

#### STENOBOTHRUS, FISCHER FR.

##### \* 1. *S. CURTIPENNIS*.

*Locusta curtipennis*, Harr., Cat. Ins. Mass.; 56. (1835.)

*Chloëaltis curtipennis*, Harr., Report, 3d ed.; 184. Pl. 3, fig. 1. (1862.)

This is our most common species, and is very abundant. The figure in Harris's Report is a very poor one; the antennæ are more than one half too short, and the pronotum is inaccurately rendered.

Mass., (H. Coll., Agassiz, Miss Edmands, Shurtleff, Sanborn, S. H. S.) Maine, (Packard.) Conn., (Norton, S. H. S.) Red River Settlements, British America, (S. H. S.)

##### \* 2. *S. MELANOPLEURUS*, nov. sp.

Vertex of the head broad, expanded to a blunt point on either side in front of the eyes, triangular, very blunt at the apex; edge upturned with a very slight median ridge, scarcely crossing the vertex; no foveolæ; pronotum with lateral carinæ nearly parallel, slightly approaching one another in the middle; median carina sharp, rather more distinct than the lateral; posterior border of pronotum



straight; wing-covers slightly shorter than the body; wings nearly abortive.

Brown; sides of the pronotum, and of the first two or three abdominal segments, shining black; face and mouth-parts paler; a reddish brown, curved streak on the top of the head from inner edge of eye to lateral carinæ of pronotum; legs yellowish brown; posterior femora with one or two dark streaks on the sides; posterior tibiæ black at tip and base.

Length of body, .67 in.; of antennæ, .39 in.; of wing-covers, .38 in.; of hind femora, .42 in. 2 ♂.

Mass., (S. H. S.) Maine, (Packard.)

Easily distinguished from any other species by the black sides of the pronotum.

\*3. *S. LONGIPENNIS*, nov. sp.

Vertex of the head as in *S. melanopleurus*, but with no median ridge, and having very distinct foveolæ, long, narrow, deep; lateral carinæ of pronotum equally prominent with the median, approximate, convergent anteriorly, divergent at posterior border; coarse, shallow punctures on the posterior half of pronotum; posterior border arcuated; wing-covers longer than body; wings scarcely shorter than wing-covers.

Head and thorax brown; a broad, black band on the sides, behind the eye, extending to hind edge of pronotum, limited above by the lateral carinæ, below merging into the brown; a narrow, straight, longitudinal streak on top of head, starting from inner border of the eye; parts of the mouth yellowish; antennæ yellowish brown at base, the rest brown or black; legs yellowish brown; hind tibiæ, except the black base, and slender portion of hind femora reddish brown, extremity black; abdomen yellow beneath, above brown; wing-covers uniform brown.

Length of body, ♂ .55 in., ♀ .7 in.; of antennæ, ♂ .36

in., ♀ .28 in.; of hind femora, .44 in.; of wing-covers, .65 in. 7 specimens.

Mass., (H. Coll., Miss Edmands, Sanborn, S. H. S.)

4. *S. SPECIOSUS*, nov. sp.

Vertex of the head quite broad, not expanding at the sides, apex not rounded, the sides of the angle straight; edges upturned considerably; a slight median groove; no foveolæ; sides of the pronotum approximate, constricted in the middle; lateral foveolæ not so prominent and sharp as the median; wings as long as the wing-covers, extending beyond the tip of abdomen.

Above brown; below pale yellow; face yellowish brown; mouth-parts pale yellow; antennæ reddish brown; a narrow, curved streak on top of the head from inner edge of eye to lateral carinæ; a narrow, straight, white streak from eye to lateral carinæ; upper half of sides of pronotum brownish, darkest above; legs yellowish brown; spines of hind tibiæ tipped with black; wing-covers brownish at base, apical half pellucid, with rosaceous nervures; wings pellucid with rosaceous nervures; costa with a dark streak beyond the middle.

Length of body, .55 in.; of antennæ, .23 in.; of hind femora, .34 in.; expanse of wing-covers, 1 in.; of wings, .44 in. 1 ♂.

St. Paul, Minnesota, (S. H. S.)

The above-mentioned species have all immaculate wing-covers; those to be mentioned have all spots or streaks on them.

\* 5. *S. MACULIPENNIS*, nov. sp.

Vertex of the head rather broad, with elevated edges, with no expansion of the sides in advance of the eyes; the apex blunt, with long, shallow foveolæ, broader toward the eye than at the apex; lateral carinæ of the pronotum convergent at the anterior half, very divergent at the posterior border, somewhat elevated but not rounded; median

carina sharp, high; hind border of pronotum angulated, angle rounded; wings equally with wing-covers, extending back beyond the abdomen.

Head and top of pronotum green (some individuals brown); a reddish-brown, broad band behind the eye reaches the hind edge of sides of pronotum, limited above by the lateral carinæ, which are white, but crossing this posteriorly and filling the triangular space on top of pronotum, made by the divergence of the carinæ at the posterior border; sides of pronotum below the band brownish; wing-covers green, with a medial band of equidistant, square, black spots along its whole extent, besides a few irregularly scattered smaller black spots; sometimes the inner halves of the wing-covers are entirely of a rust-red color; legs yellowish brown; the hind femora sometimes streaked; the hind tibiæ plumbeous, with a broad, pale, indistinct annulation near the base; antennæ with the basal half reddish, the apical brownish.

Length of body, ♂ .55 in., ♀ .75 in.; of antennæ, ♀ .26 in.; of hind femora, .45 in.; of wing-covers, ♂ .4 in., ♀ .7 in.

Mass., (H. Coll., Shurtleff, Sanborn, S. H. S.)

\*6. *S. ÆQUALIS*, nov.\*sp.

Very similar in general appearance to *S. maculipennis*, but a smaller species, with wing-covers extending only to the extremity of abdomen.

Vertex of head broad and blunt, the sides slightly swollen at the anterior border of the eye, the apex blunt, and all the angles rounded; the edge slightly and not sharply upturned; foveolæ shallow, short, nearly equiangular; lateral carinæ of the pronotum curved inward a little in the middle, not so prominent as the sharp medial carina; hind border slightly angular, but nearly straight; wings and wing-covers just reaching the extremity of the abdomen.

Colored much as in *S. maculipennis*; the lateral ca-

rinæ are yellow, and the band extends forwards to the eye; the band behind the eye is quite narrow, and the sides below it green, like the parts above, and the triangular dash of black upon the top of the pronotum at the hinder angles is much narrower than there, on account of the lesser divergence of the lateral carinæ; the medial band of the wing-covers containing the square black spots is yellowish brown as in *S. maculipennis*, and the extremity is pellucid.

Length of body, ♂ .45 in., ♀ .66 in.; of antennæ, ♂ .24 in., ♀ .2 in.; of hind femora, ♂ .3 in., ♀ .38 in.; of wing-cover, ♂ .34 in., ♀ .46 in.

Mass., (Shurtleff, Sanborn, S. H. S.) Maine, (Packard.) N. Y., (H. Coll.) Minnesota, (S. H. S.)

\*7. *S. BILINEATUS*, nov. sp.

Vertex of the head slightly swollen at anterior border of the eye, but rounded as is also the apex; edges not upturned; foveolæ only indicated by a very faint, scarcely perceptible depression; sides of the pronotum rather suddenly constricted in the middle, the lateral carinæ broader than the sharp medial one; hind border of pronotum slightly rounded; wing-covers of the length of the abdomen.

Brown, generally dark; face yellowish brown, blotched with black; a narrow black band extends from the tip of the vertex along each side, extending back on to the pronotum by the side of the lateral carinæ to the posterior border, widening upon the pronotum; the usual black band behind the eye is rather broad, and there is another similar one on the pronotum farther down the side, with a yellowish streak between them; the wing-covers are brown with a medial row of darker spots; the legs are brownish, with the extremity of the hind femora and the base of the hind tibiæ darker.

Length of body, ♂ .5 in., ♀ .65 in.; of antennæ, ♂



.22 in., ♀ .19 in.; of hind femora, ♂ .32 in., ♀ .36 in.; of wing-covers, ♂ .36 in., ♀ .41 in.

Mass., (H. Coll., Sanborn, Shurtleff, S. H. S.)

\* 8. *S. PROPINQUANS*, nov. sp.

Very similar to the preceding, but of a larger size, and has proportionally longer wings. It is also closely allied to *S. maculipennis*.

Vertex broad, expanding but slightly at anterior border of the eye, the angle rounded, the apex blunt, edges scarcely if at all raised, foveolæ as in *S. maculipennis*, but more shallow; lateral carinæ of pronotum somewhat convergent in the middle, of equal prominence and sharpness with the medial; hind border of pronotum somewhat rounded; wings a little longer than abdomen.

Brown; band behind eye quite broad; lateral carinæ yellowish; a faint curved dark band from inner border of eye to lateral carinæ; antennæ yellowish brown; wing-covers brownish at base, transparent at tip, with a medial band of brown spots extending two thirds of the distance to the tip; legs yellowish brown; hind tibiæ plumbeous, with a broad pale annulation at base.

Length of body, ♂ .6 in., ♀ .75 in.; of antennæ, ♂ .26 in., ♀ .23 in.; of hind femora, ♂ .33 in., ♀ .48 in.; of wing-covers, ♂ .55 in., ♀ .68 in.

Conn., (Norton.) Minnesota, (S. H. S.)

#### TRAGOCEPHALA, HARRIS.

\* 1. *T. INFUSCATA*, Harr., Report, 3d ed.; 181. (1862.)

*Gomphocerus infuscata*, Uhl. in Harr., Report, 3d ed.; 181. (1862.)

Mass., (H. Coll., Sanborn, Shurtleff.) Maine, (Packard.) N. Hampshire, (H. Coll.) Conn., (Norton.)

\* 2. *T. VIRIDIFASCIATA*, Harr., Report, 3d ed.; 182. Pl. 3, fig. 2. (1862.)

For synonymy see Harris's Report; to which add:—

- T. radiata*, Harr., Report, 3d ed.; 183. (1862.)  
*Locusta viridifasciata*, Harr., Cat. Ins. Mass.; 56. (1835.)  
Mass., (H. Coll., Shurtleff, Sanborn.) Maine, (Packard.)  
Conn., (Norton.) Maryland, (Uhler.)

## ARCYPTERA, SERVILE.

*Stetheophyma*, Fischer Fr.\* 1. *A. LINEATA*, nov. sp.

Vertex of the head broad, slightly swollen at front border of the eye, apex docked, edge raised to a ridge, with a medial ridge extending over the whole top of the head; foveolæ small, shallow, triangular; lateral carinæ parallel in anterior half of pronotum, somewhat divergent behind, not so high as the medial, and much broken; wing-covers long and slender, with no swollen curves, the costal border not so prominent near the base as is usual in this genus; pronotum rugose.

Dark brown; a narrow curved dark line extends from the upper border of the eye to the lateral carinæ of the pronotum, and is the inner limit of a broad brownish yellow band which extends from the eye to the lateral carinæ, whence it continues backwards along the carinæ; below this upon the upper border of the side extends another broad black band from the eye to hind edge of pronotum; the medial carina is black; the wing-covers have the costal edge dark, beneath which is a yellow streak extending from base to the costal border at about two thirds the distance to the apex; beneath this is a band, narrow and black at base, broadening till it occupies the whole width of wing-cover, and becoming brown toward the tip, while the inner border is yellowish brown; wings dusky, the internal half with a yellowish tinge; legs dark brown; hind femora black on the outer and inner surface, reddish brown above, coral red below, with a white spot near apex, and the tip black; hind tibiæ yellow with black spines,

with the base and tip black, and a dusky annulation at the upper limit of the spines.

Length of body, ♂ 1 in., ♀ 1.4 in.; of wing-cover, ♀ 1.12 in.; breadth of wing-cover in middle, ♀ .22 in.; length of hind femora, .72 in. 1 ♂, 1 ♀.

Mass., (Sanborn.)

\* 2. *A. PLATYPTERA*, nov. sp.

Vertex of head much as in *A. lineata*, with the apex more rounded, and the edge scarcely prominent; foveolæ only discernible as faint depressions, slightly longer than in *A. lineata*; sides of pronotum regularly but slightly divergent; medial carina more prominent; pronotum rugose as in *A. lineata*; wing-covers short and broad, costal border considerably swollen near the base, internal border full.

Dark reddish brown, marked on head and prothorax similarly to *A. lineata*, but with the colors much suppressed; wing-covers uniform pale brownish, transparent; wings transparent, colorless, with the nervures of the anterior half black.

Length of body, 1.2 in.; of wing-covers, .83 in.; breadth of wing-covers in middle, .21 in.; length of hind femora .68 in. 1 ♀.

New England, (Agassiz.)

\* 3. *A. GRACILIS*, nov. sp.

Vertex of the head as in *A. lineata*, except that it is more pointed, narrower, and more rounded at the tip; foveolæ long and narrow, triangular, rather deep; pronotum as in *A. lineata*; wing-covers much as in *A. platyptera*, though the costal border is not swollen so much.

Dark brown; markings of head and thorax much as in *A. lineata*, though not so distinct; the band on the upper border of the sides of pronotum behind the eye is narrow, instead of broad; wing-covers uniform dusky brown, except the internal border which is yellowish brown; wings as in *A. lineata*; hind femora reddish, black at tip; hind

tibiæ as in *A. lineata*, with the markings rather more distinct.

Length of body, .85 in.; of wing-covers, .78 in.; breadth of wing-covers in middle, .22 in.; length of hind femora, .52 in. 5 ♂.

Maine, (Packard.) Red River Settlements, British America, (S. H. S.)

PEZOTETTIX, BURMEISTER.

1. *P. BOREALIS*, nov. sp.

Vertex of the head with a broad longitudinal furrow in advance of the middle of the eyes; sides of pronotum very nearly parallel, slightly wider at hind border which is arcuate; medial carina slightly higher than lateral, not prominent; wing-covers longer than wings, not quite reaching the extremity of the abdomen.

Dark brown, darkest above; a broad black band behind the eye, extending over the upper portion of the sides of pronotum to the hind border; front dark yellowish brown; mouth-parts dirty yellowish; legs yellowish brown; hind femora streaked with black, with the tip black; hind tibiæ reddish, with a faint paler annulation near base, the spines tipped with black; wing-covers dirty yellowish brown, spotted irregularly with darker brown; wings colorless, a little dusky on costal border.

Length of body, .65 in.; of wing covers, .4 in.; of hind femora, .4 in.

Minnesota, (S. H. S.) Saskatchewan River, British America, (S. H. S.) Lake Winnipeg, (S. H. S.) Anticosti, Gulf St. Lawrence, (Verrill.)

CALOPTENUS, SERVILE (*emend.*)

- \* 1. *C. FEMUR-RUBRUM*, Burm., Handb. d. Ent.; II. 638.  
(1838.)

*C. femur-rubrum*, Uhler in Harr., Report, 3d ed.; 174.  
(1862.)



*Acrydium femur-rubrum*, Harr., Cat. Ins. Mass.; 56.  
(1835.)

“ “ Harr., Report, 3d ed.; 174.  
fig. 80. (1862.)

For further synonymy see Harris's Report.

Mass., (H. Coll., Agassiz, Shurtleff, Miss Edmands, Sanborn, S. H. S.) Maine, (Packard.) Connecticut, (Norton.) S. Illinois, (Thomas.) Minnesota, (S. H. S.) Red River Settlements, (S. H. S.) Nebraska, (Mus. Comp. Zoöl.)

\* 2. *C. PUNCTULATUS*, Uhler Mss.

This species is very closely allied to *C. femur-rubrum*, from which it is to be distinguished by the greater prominence of the front; by the greater globosity of the eyes; by the markings of the wing-covers and hind legs, and the sculpture of the valves of the ovipositor; the wing-covers are of the same color as in *C. femur-rubrum*, with the square dark spots not limited to a medial band, but found equally above and below this, extending nearly to the tip; the hind femora have upon the outside alternate, transverse, straight bands of black and brownish-yellow, three of each in number; hind tibiæ brownish-red with black spines, with a narrow black annulation at the base, followed by a wider yellowish one; the upper valves of the ovipositor are not curved so deeply on their upper surface, nor so upturned and pointed at their tip as in *C. femur-rubrum*; the lower valves, too, are much straighter, bent downwards scarcely at all at their tip, and the lateral tooth, so apparent in *C. femur-rubrum*, is here almost obsolete.

Length of body, 1.1 in.; of wing-covers, .69 in.; of hind femora, .48 in.; 1 ♀. I have seen only a single specimen sent me by Mr. Uhler under the above name.

Maine, (Packard.)

\* 3. *C. BIVITTATUS*, Uhler in Say, Ent. of N. Am. (Ed. LeConte); II. 238. (1859.)

*C. bivittatus*, Uhler in Harr., Report, 3d ed.; 174. (1862.)

*Gryllus bivittatus*, Say, Journ. Ac. Nat. Sc. Phil.; IV.  
308. (1825.)

*Locusta leucostoma*, Kirby, Faun. Bor. Am. Ins.; 250.  
(1837.)

*Caloptenus femoratus*, Burm., Handb. d. Ent.; II. 638.  
(1838.)

“ “ Burm., teste Erichson, Archiv.  
f. Nat.; IX. 229. (1843.)

*Acrydium sanguinipes*, Harr., Cat. Ins. Mass.; 56.  
(1835.)

“ *flavovittatum*, Harr., Report, 3d ed.; 173.  
(1862.)

Mass., (H. Coll., Agassiz, Shurtleff, Miss Edmands, Sanborn.) Maine, (Packard.) Conn., (Norton.) Maryland, (Uhler.) Texas, (Uhler.) Nebraska, (Mus. Comp. Zool.) S. Illinois, (Thomas.) Minnesota, (S. H. S.) Lake Winnipeg, (S. H. S.)

#### ACRIDIDIUM, GEOFFROY.

\* 1. *A. ALUTACEUM*, Harr., Report, 3d ed.; 173. (1862.)

*A. torvum*, Say Mss. and Harr., Cat. Ins. Mass.; 56.  
(1835.)

*A. rusticum*, Burm., Handb. d. Ent.; II. 633. (1838.)

(Not *Gryllus rusticus*, Fabr., Ent. Syst.; 292.)

Martha's Vineyard, Mass., (H. Coll.) Conn., (Norton.)

3 specimens.

2. *A. AMERICANUM*.

*Gryllus americanus*, Drury, Ill.; II. App.\* Deser. and  
fig., I. 128. Pl. 49, fig. 2. (1773.)

*Locusta tartarica*, Westwood in Drury, Ill.; I. 121. Pl.  
49, fig. 2. (1837.)

(Not *Gryllus tartaricus*, Linn., &c.)

N. Carolina, (H. Coll.) Southern States, (Mus. Comp.

\* According to Westwood in his edition of Drury; the only copies of the old edition of Drury, which I have seen, have no appendix in any volume.

Zoöl.) Florida, (Norton.) Alabama, (H. Coll.) Texas, (Mus. Comp. Zoöl.) S. Illinois, (Thomas.)

3. *A. OBSCURUM*, Burm., Handb. d. Ent.; II. 632. (1838.)

*Gryllus obscurus*, Fabr., Syst. Ent. Suppl.; 194. (1798.)

This species has much stouter legs than the others.

Texas, (Mus. Comp. Zoöl., Uhler.)

("The *obscurum*? F. of H. Cat. is not in cabinet of T. W. H." Harris Mss.)

\* 4. *A. RUBIGINOSUM*, Harris Mss.

"Light rust-red; face with four elevated lines, the two lateral ones not so distinct as in *A. alutaceum*; thorax with a very distinct ridge along the middle; wing-covers opaque, rather paler on the overlapping portion than elsewhere, with a projection on the outer margin near the shoulder; wings transparent and glassy, slightly reddish towards the tip and netted with blackish veins; hindmost thighs reddish within and without, the whitish part bounded on both sides by a row of distant black dots, and crossed like a herring-bone with reddish lines; knees of the same legs with a curved black line on each side, spines of the shins white tipped with black. Length,  $1\frac{3}{4}$  in.; expanse of wings, nearly 3 inches. So. Carolina, from Mr. Nuttall and Dr. Holbrook." Harris Mss.

Dr. Harris does not mention the faint dark spots on the wing-covers, similar in disposition to those on *A. alutaceum*; there is some variation in the elevation of the medial carina of the pronotum, some individuals showing it but indistinctly.

Cape Cod, (Sanborn, S. H. S.) Conn., (Norton.) Southern States, (Mus. Comp. Zoöl.) Alabama, (H. Coll.) So. Carolina, (H. Coll.)

#### ÆDIPODA, LATREILLE.

I have here included all the species which would be embraced in the old genus *Ædipoda* of Latreille; it is

easy to see that it should be divided, and especially that *Æ. Carolina*, Burm., and *Æ. sordida*, Burm., should each be separated from it, but the desire of having fuller material before attempting such a task prevents my undertaking it at present.

- \* 1. *Æ. CAROLINA*, Burm., Handb. d. Ent.; II. 643. (1838.)

*Æ. carolina*, Serv., Hist. Nat. d. Orth.; 722. (1839.)

“ “ Uhl. in Harr., Report, 3d ed.; 176. (1862.)

*Locusta caroliniana etc.* Catesby, Nat. Hist. of N. Car.; II. 89. Tab. 89. (1743.)

*Gryllus (Locusta) carolinus*, Linn., Syst. Nat.; II. 701. (1767.)

“ “ “ Stoll, Spectres, &c. Pl. XVIII. b. fig. 68. (1813.)

*Gryllus carolinus*, Fabr., Syst. Ent.; 291. (1775.)

“ “ “ Spec. Ins.; I. 368. (1781.)

“ “ “ Mant. Ins.; I. 238. (1787.)

“ “ “ Ent. Syst.; II. 58. (1743.)

*Acridium carolinum*, De Geer, Mem.; III. 491. Pl. 41, figs. 2, 3. (1773.)

“ “ Oliv., Enc. Meth.; IV. 225. (1791.)

*Acridium carolinianum*, Pal. de Beauv., Ins.; 147. Pl. IV, fig. 6. (1805.)

*Locusta carolina*, Harr., Cat. Ins. Mass.; 56. (1835.)

“ “ Harr., Report, 3d ed.; 176. Pl. 3, fig. 3. (1862.)

Mass., (H. Coll., Miss Edmands, Shurtleff, Agassiz, Sanborn, S. H. S.) Maine, (Packard.) Conn., (H. Coll., Norton.)

- \* 2. *Æ. PHOENICOPTERA*, Germ. in Burm., Handb. d. Ent.; II. 643. (1838.)

“ “ Germ., teste Erichson, Archiv. f. Nat. IX. 229. (1843.)

*Ædipoda oblitterata*, Germ. in Burm., Handb. d. Ent.; II. 643. (1838.)



- Locusta apiculata*, Say Mss., and Harr., Cat. Ins. Mass.;  
56. (1835.)  
*Locusta corallina*, Harr., Report, 3d ed.; 176. (1862.)  
Mass., (H. Coll., Shurtleff, Sanborn, S. H. S.) Maine,  
(Packard.) Conn., (Norton.)  
3. *Æ. discoidea*, Serv., Hist. Nat. d. Orth.; 724. (1835.)  
*Acridium tuberculatum*, Pal. de Beauv., Ins.; 145. Pl.  
IV, fig. 1. (1805.)  
(Not *Gryllus tuberculatus*, Fabr.)  
N. Carolina, (H. Coll.) Southern States, (Mus. Comp.  
Zoöl.)

\* 4. *Æ. rugosa*, nov. sp.

This species is closely allied to *Æ. discoidea*. The head and thorax are dark brown; two yellowish bands run from behind the eye backwards and inwards, nearly or quite meeting one another a little in advance of the middle of the pronotum, where they diverge and strike the hinder edge of the pronotum at the outer angles; there are two yellowish spots, one below the other, on the sides of the pronotum; the wing-covers are marked much as in *Æ. discoidea*, but the dark blotches are larger and fully as abundant, generally occupying the larger portion of the wing, so that it might better be described as very dark brown with light blotches; the tip of the wing-cover is pellucid, nearly free of spots; the wings are as in *Æ. discoidea*, with the basal color pale-yellowish instead of red, and the apical portion less dusky than there.

Length of body, ♂ 1.1 in., ♀ 1.4 in.; expanse of wings, ♂ 1.9 in., ♀ 3 in.; depth of wings, ♂ .5 in., ♀ .7 in. 4 specimens.

Mass., (Agassiz.) Maine, (Packard.)

\* 5. *Æ. xanthoptera*, Germ. in Burm., Handb. d. Ent.;  
II. 643. (1838.)

Mass., (H. Coll., Agassiz, Sanborn, Shurtleff,) Missouri,  
(S. H. S.)

\* 6. *Æ. sulphurea*, Burm., Handb. d. Ent.; II. 643. (1838.)

“ “ Uhl. in Harr., Report, 3d ed.; 177. (1862.)

*Gryllus sulphureus*, Fabr., Spec. Ins.; I. 369. (1781.)

“ “ “ Mant. Ins.; I. 239. (1787.)

“ “ “ Sys. Ent.; II. 59. (1793.)

*Acridium sulphureum*, Oliv., Enc. Meth.; IV. 227. (1791.)

“ “ Pal. de Beauv., Ins.; 145. Pl. 4, fig. 2. (1805.)

*Locusta sulphurea*, Harr., Cat. Ins. Mass.; 56. (1835.)

“ “ “ Report, 3d ed.; 177. Pl. 1, fig. 6. (1862.)

Mass., (H. Coll., Sanborn, Shurtleff.) Maine, (Packard.) Conn., (Norton.)

*Æ. sulphurea* differs from *Æ. xanthoptera* in its smaller size (the males of *Æ. xanthoptera* equalling in size the females of *Æ. sulphurea*), in the squareness and greater size of the foveolæ of vertex, in the direction of the edges of the ridge down the front (which in *Æ. sulphurea* are brought together at the vertex), in the direction of the hind-border of the pronotum (which is much more angulated in *Æ. xanthoptera*), in the greater depth of the wing in *Æ. xanthoptera*, and also in the band of the wing, which in both species has the inner border turned considerably inwards close to the costal border, and then outwards again just before the edge, but which in *Æ. sulphurea* extends inwards fully half way to the base of the wing, while in *Æ. xanthoptera* it does not reach one quarter the distance.

\* 7. *Æ. æqualis*, Uhl. in Harr., Report, 3d ed.; 178. (1862.)

*Gryllus æqualis*, Say, Journ. Acad. Nat. Sc. Phil.; IV. 307. (1825.)

“ “ Say, Ent. of N. Am. (ed. Le Conte); II. 237. (1859.)

*Locusta æqualis*, Harr., Cat. Ins. Mass.; 56. (1835.)

" " " Report, 3d ed.; 178. (1862.)

Mass., (H. Coll., Agassiz, Shurtleff, Sanborn, S. H. S.)  
Conn., (Norton, S. H. S.) Minnesota, (S. H. S.) Red  
River, British Am. (S. H. S.)

\* 8. *Œ. verruculata*.

*Locusta verruculata*, Kirby, Faun. Bor. Am. Ins.; 250.  
(1837.)

" *latipennis*, Harr., Report, 3d ed.; 179. (1862.)

*Œdipoda latipennis*=*æqualis*, Uhl. in Harr., Report, 3d  
ed.; 178. (1862.)

Mass., (H. Coll., Sanborn, Shurtleff, Agassiz, S. H.  
S.) N. Hampshire, (H. Coll.) White Mts., (Agassiz.)  
Maine, (Packard.) Lake Winnipeg, (S. H. S.) Saguenay  
River, Canada East, (Norton.)

*Œ. verruculata* differs from *Œ. æqualis* in the following particulars: in *Œ. æqualis* the black band across the middle of the wings is broad, its outer edge as well as the inner distinct, the outer border at first straight, then well rounded, curving inwards where it approaches the outer border; beyond the band the wing is pellucid, with black veins, not cloudy, and at the tip there is either a dusky patch or irregularly clustered square blackish spots. In *Œ. verruculata* the inner border of the band is more wavy and is illy defined; the outer border is straight, and where it approaches the outer border of the wing, is turned slightly outwards instead of inwards, and is frequently very indistinct, being merged into the more or less dusky space beyond it, which increases in cloudiness to the tip, where it is as dark as the band. The band itself is quite narrow in the middle, so that it might be said to be made up of two triangular patches which meet and merge in the middle. The broadest band I have seen in *Œ. verruculata*, is not more than half the width of the narrowest in *Œ. æqualis*. In *Œ. æqualis* the hind tibiæ are either wholly

coral-red or have a pale yellowish annulation at the base. In *Æ. verruculata* the tibiæ have the base and apex black, with the middle half yellowish or plumbeous, with generally a dusky annulation in the middle.

- \* 9. *Æ. MARITIMA*, Uhl. in Harr., Report, 3d ed.; 178. (1862.)

*Locusta maritima*, Harr., Report, 3d ed.; 178. (1862.)

Sea-shore of Mass., (H. Coll., Sanborn, Miss Edmands, S. H. S.) Conn., (Norton.)

- \* 10. *Æ. MARMORATA*, Uhl. in Harr., Report, 3d ed.; 179. (1862.)

*Locusta cerineipennis*, Harr., Cat. Ins. Mass.; 56. (1835.)

" *marmorata*, Harr., Report, 3d ed.; 179. (1862.)  
Mass., (H. Coll., A. Agassiz, Shurtleff, Sanborn.)

- \* 11. *Æ. EUCERATA*, Uhl. in Harr., Report, 3d ed.; 180. (1862.)

*Locusta eucerata*, Harr., Cat. Ins. Mass.; 56. (1835.)

" " " Report, 3d ed.; 180. (1862.)

Mass., (H. Coll., Shurtleff, Sanborn, S. H. S.) Conn., (Norton, S. H. S.)

- \* 12. *Æ. PELLUCIDA*, nov. sp.

Ash brown; face reddish brown; antennæ yellowish at base, dark brown toward tip; a triangular black spot behind the eye, the apex touching it; a quadrate transverse black spot on the anterior upper portion of the sides of pronotum; pronotum above, sometimes with a dark band down the middle; wing-covers with the basal half dark brown, with small yellowish spots and transverse streaks, especially on front border; apical half clear, with dark brown rounded spots, prevalent along the middle, decreasing in size toward the tip; when closed, the upper surface is dark brown, with a rather broad yellowish vitta along each angle on the upper surface; wings pellucid, with black nervules; legs dark brown, the hind femora yellowish or reddish-brown, with two or three rather broad



diagonal dark-brown streaks, dark at the apex; hind tibiæ yellowish-brown, reddish toward the tip, with a very narrow, generally faint, annulation of dark-brown at the base; spines tipped with black.

Length of body, ♂ .65 in., ♀ 1 in.; spread of wings, ♂ 1.3 in., ♀ 1.6 in.; depth of wings, ♂ .33 in., ♀ .4 in.

Mass., (Miss Edmands, Agassiz, Sanborn, S. H. S.)  
Vermont, (S. H. S.) Maine, (Packard.) Conn., (Norton.)

\* 13. *Œ. sordida*, Burm., Handb. d. Ent.; II. 643.  
(1838.)

*Locusta periscelidis*, Say Mss., and Harr., Cat. Ins.  
Mass.; 56. (1835.)

*Locusta nebulosa*, Harr., Report, 3d ed.; 181. (1862.)

*Edipoda nebulosa*, Uhl. in Harr., Report, 3d ed.; 181.  
(1862.)

Mass., (H. Coll., Agassiz, Shurtleff, Sanborn, S. H. S.)  
Maine, (Packard.) Conn., (Norton.)

14. *Œ. costalis*, nov. sp.

Brownish-yellow, profusely mottled with reddish-brown; a broad yellowish band extends from each eye to the opposite outer posterior angle of the pronotum, crossing at the middle of the pronotum, bordered outside with a broad band of black, narrowing posteriorly to a line, and inside, behind the intersection, by a broad black band, which has another narrow short black line parallel to it at the hind border of the pronotum; medial carina of pronotum equal, rather sharp, not high; wing-covers much as in *Œ. sordida*; wings pellucid, with a faint cloudy patch at the middle of the outer border, and a dark streak along the costal border toward the apex; hind femora yellowish, with two transverse dark annulations, the tips dark brown; hind tibiæ bluish with black spines and a yellowish annulation at base. This species differs from *Œ. sordida*, in the markings and lowness of the ridge of pronotum, and in the shorter and fuller wings.

Length of body, 1.05 in.; spread of wings, 1.75 in.; depth, .46 in. 1 ♀.

Texas, (Mus. Comp. Zoöl.)

TETRIX, LATREILLE (*emend.*)

See *Tettigidea* and *Batrachidea*.

\* 1. *T. GRANULATA*.

*Acrydium granulatum*, Kirby, Faun. Bor. Am. Ins.; 251. (1837.)

*Tetrix ornata*, Harr., Cat. Ins. Mass.; 57. (1835.)

“ “ Harr., Report, 3d ed.; 186. (1862.)

(Not *Acrydium ornatum*, Say.)

This species may be distinguished from *T. ornata*, by its longer pronotum and greater size, and also by the prominence of the vertex, which advances considerably in front of the eyes, having the front border angulated; in this latter feature it may also be similarly distinguished from *T. cucullata* and *T. rugosa*, as also by its narrower pronotum; the males are much narrower than the females.

Mass., (H. Coll., Sanborn, Shurtleff, S. H. S.) Maine, (Packard.) N. Hampshire, (H. Coll.) Minnesota, (S. H. S.)

\* 2. *T. ORNATA*.

*Acrydium ornatum*, Say, Amer. Entom.; I. Pl. V. (1824.)

“ “ Say, Ent. of N. Am. (ed. LeConte); I. 10. Pl. V. fig. 1. (1859.)

*Tetrix arenosa*, Burm., Handb. d. Ent.; II. 659. (1838.)

“ *dorsalis*, Harr., Report, 3d ed.; 186. (1862.)

“ *quadrimaculata*, Harr., Report, 3d ed.; 186. (1862.)

“ *bilineata*, Harr., Report, 3d ed.; 186. (1862.)

“ *sordida*, Harr., Cat. Ins. Mass.; 57. (1835.)

“ “ Harr., Report, 3d ed.; 187. (1862.)

(Not *Tetrix ornata*, Harr., Cat. and Report.)

This species is smaller than *T. granulatum*, has the vertex but little thrust forward in advance of the eyes, and

the front border nearly straight instead of angulated; the pronotum is shorter than in the preceding, and the wings are smaller; both this and the preceding species have almost every conceivable variation of ornamentation, upon which almost exclusively Harris established his specific differences, but as Uhler has remarked, "color and style of marking is of very little value in separating the species of *Tettix*."

Mass., (H. Coll., Sanborn, Shurtleff.) N. Hampshire, (H. Coll.) Maine, (H. Coll., Packard.) Vermont, (S. H. S.) Conn., (Norton.) S. Illinois, (Thomas.) St. Louis, Missouri, (Sanborn, S. H. S.)

\* 3. *T. TRIANGULARIS*, nov. sp.

Allied to *T. ornata*, and agreeing with it in ornamentation, in the character of the vertex, the prominence of the eyes, but differing in the length of the pronotum and wings; as in both of the preceding species, the pronotum and wings are of equal length, but in this the pronotum is scarcely longer than the body, and is not produced backward into such a slender point, the sides being straighter; the breadth is contained three times in the length; it is a smaller species than the preceding.

Length of pronotum, .17 in. 2 ♂, 2 ♀.

Mass., (S. H. S.) Maine, (Packard.) N. Hampshire, (H. Coll.)

\* 4. *T. CUCULLATA*, Burm., Handb. d. Ent.; II. 658. (1838.)

Differs from *T. granulata*, which it most resembles, in having the vertex very narrow, slightly less than the diameter of the much inflated eyes, the front cut off square, and slightly hollowed, not projecting outward so far as the eyes; the pronotum is broader and more compact over the thorax, more suddenly sloped off behind and extending backwards nearly twice the length of the abdomen, the wings overreaching slightly; the punctures upon the

wing-covers are of the same size, but not so deep as in *T. granulata*.

Length of pronotum, ♂, .4 in., ♀ .5 in. 2 ♂, 2 ♀.

Mass., (S. H. S.) Missouri, (Mus. Comp. Zoöl., Sanborn.)

5. *T. RUGOSA*, nov. sp.

Closely allied to *T. cucullata*, agreeing with it in general form and size, shape and length of the pronotum, and length of the wings. The front border of the vertex is as in *T. cucullata*, but it is broader, and the eyes are scarcely as prominent. The whole surface of the pronotum, instead of being delicately granulated as in *T. cucullata*, with the medial and marginal carinæ faint, has these carinæ quite prominent, and the whole surface rugose, deeply scarred and pitted, with irregular granulated depressions; the wing-covers are punctured as in *T. granulata*.

Length of pronotum, .54 in. 1 ♀.

N. Florida, (Norton.)

TETTIGIDEA, Nov. gen. (τέτιγξ, ἰδέα.)

This genus when compared with *Tettix* will be found to differ in having a more robust and clumsy form, a larger head, more swollen upon the top, and less sloping down the front, the medial ridge in front more prominent, the antennæ consisting of twenty-two joints, which are cylindrical and not flattened; in the joints of the maxillary palpi, which here have the fourth joint much larger at the apex than at the base, somewhat swollen, with a sharp medial external ridge, and the fifth much swollen, flattened, with a faint similar ridge, and slightly docked at the tip; as in *Tettix* and *Batrachidea* the first joint is longer than broad, cylindrical, the second slightly shorter than broad, cylindrical, both together equalling the third, which is of the same length as the fourth or fifth, and cylindrical; the lower anterior angle of the sides of pronotum, which is



angulated and bent inwards in *Tettix*, is here rounded and straighter; the lateral carinæ are not so prominent as there, or so strongly bent inwards in advance of the broader portion; the front border is thrust forward at an angle partially concealing the head; the prosternum is very strongly folded transversely, forming a very deep, sharp, angulated groove, which in *Tettix* is not nearly so deep, nor are its sides so nearly approximated; wing-covers considerably longer and narrower than in *Tettix*. This genus further differs from *Tettix* in that there is a small circular swollen space devoid of facets, set off from the upper inner border of the eye. The same is true of *Batrachidea*, but much more indistinctly, since it cannot be discovered without the aid of such a lens as will readily separate the facets of the eye.

\* 1. T. LATERALIS.

- Acrydium laterale*, Say, Am. Ent.; I. Pl. 5. (1824.)  
 “ “ Say, Ent. of N. Am. (ed. Le Conte);  
 I. 10. Pl. 5, figs. 2, 3. (1859.)  
*Tetrix lateralis*, Harr., Cat. Ins. Mass.; 57. (1835.)  
 “ “ Harr., Report, 3d ed.; 187. (1862.)  
 “ *polymorpha*, var. A, Burm., Handb. d. Ent.; II.  
 659. (1838.)  
 Mass., (H. Coll., Sanborn.) Maine, (Packard.) N.  
 Hampshire, (H. Coll.) Conn., (Norton.) S. Illinois,  
 (Thomas.)

\* 1. T. POLYMORPHA.

- Tetrix polymorpha*, var. B, Burm., Handb. d. Ent.; II.  
 659. (1838.)  
*Tetrix parvipennis*, Harr., Cat. Ins. Mass.; 57. (1835.)  
 “ “ Harr., Report, 3d ed.; 187, fig. 82.  
 (1862.)

In this species the wings are almost abortive, and the pronotum extends only to the tip of the abdomen, while in *T. lateralis* the wings extend beyond the pronotum,

which is itself much longer than the body; *T. polymorpha* is the more abundant species.

Mass., (H. Coll., Sanborn.) Maine, (H. Coll., Packard.) N. Hampshire, (H. Coll.) Conn., (Norton.) S. Illinois, (Thomas.) St. Louis, Missouri, (Sanborn.) Alabama, (H. Coll.)

BATRACHIDEA, SERVILLE.

This genus differs from *Tettix* in its more solid and compact form; in the larger head, the more distant eyes, the front less sloping; in the smaller number of joints in the antennæ, which have but twelve joints, while in *Tettix* there are thirteen or fourteen, generally the latter; in the shape of their joints, which are cylindrical instead of being flattened, and more swollen than in *Tettix*; in the maxillary palpi, which in *Tettix* has the fourth joint cylindrical, very slightly largest at the apex, and the fifth cylindrical and slightly swollen, while here the fourth is somewhat larger at the apex than at the base, broadly but faintly ridged outside, and the fifth swollen considerably, especially on anterior border, with a broad faint ridge outside; in the more swollen and crested summit of the head; in having the lower posterior lobes of sides of pronotum thrust downwards and outwards and but slightly backwards, and the lower anterior angle rounded; in having a very high arched median carina on pronotum, and the lateral carinæ only indicated in front; in having the front border of pronotum thrust forward over the head a little; in having on prosternum only a broad shallow rounded transverse hollowing; in having the notches on the under side of the first joint of posterior tarsi only very slight, instead of being prominent as in *Tettix* and in *Tettigidea*; in the shorter valves of the ovipositor; and in having stouter legs than in the two genera just mentioned. See also *Tettigidea*.

\* 1. B. CRISTATA.

*Tetrix cristata*, Harris Mss.

Vertex projecting beyond the eyes, front border well rounded, a little angulated, the medial carina sharp, prominent, sloping downwards posteriorly, the front deeply notched immediately in front of the eyes; eyes rather prominent, scarcely more than half as broad as the vertex; the pronotum with sides neither swollen nor hollowed, of the length of the body; the medial carina high, regularly arched; the lateral border with two shallow grooves, one anterior, the other posterior, overlapping one another in the middle; the whole pronotum is minutely scabrous, and there is generally a dark quadrate or triangular spot on either side, above the terminal half of the wing-covers; wings reaching tip of pronotum.

Length of pronotum, .33 in.

Mass., (H. Coll., Shurtleff, Sanborn, S. H. S.) Maine,  
(H. Coll., Packard.) N. Hampshire, (H. Coll.) Conn.,  
(S. H. S.)

\* 2. *B. CARINATA*, nov. sp.

The head much as in *B. cristata*, with the eyes slightly larger and more prominent; the medial carina of the pronotum sharp, regularly arched, the pronotum extending backward a good ways behind the tip of the abdomen, a little upturned towards the tip, with slightly longer wings; the lateral grooves are narrower and less distinct than in *B. cristata*, and the upper surface is more coarsely scabrous than there; marked as in *B. cristata*.

Length of body, .32 in.; of pronotum, .43 in. 1 ♂, 2 ♀.

Mass., (Sanborn, S. H. S.)

#### EXPLANATION OF WOOD-CUTS.

Fig. 1, p. 424. Fore-tibia and tarsi of *Tridactylus apicalis*, Say ♂ (magnified.)

Fig. 2, p. 442. Hind-tarsi of *Udeopsylla nigra*, Scudd. (magnified 2 diameters.)

Fig. 3, p. 443. a. Hind-tarsi of *Daihinia brevipes*, Hald. (magnified 2 diameters.)

b. Middle tarsi of *Daihinia brevipes*, Hald. (magnified 2 diameters.)

Fig. 4, p. 446. Wing-cover of *Phylloptera rotundifolia*, Scudd.

Fig. 5, p. 446. Wing-cover of *Microcentrum affiliatum*, Scudd.

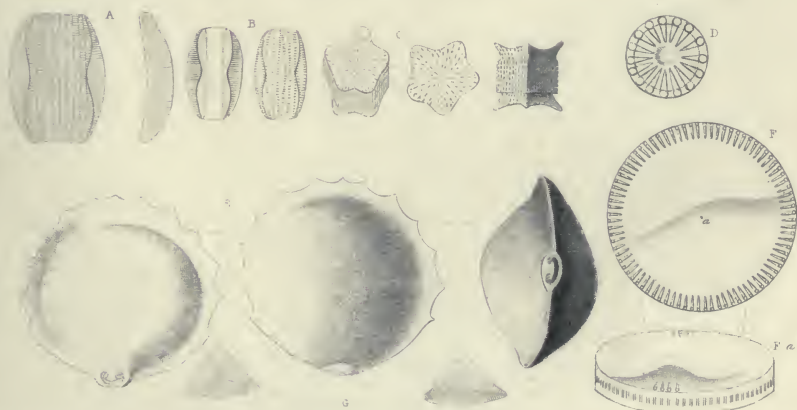
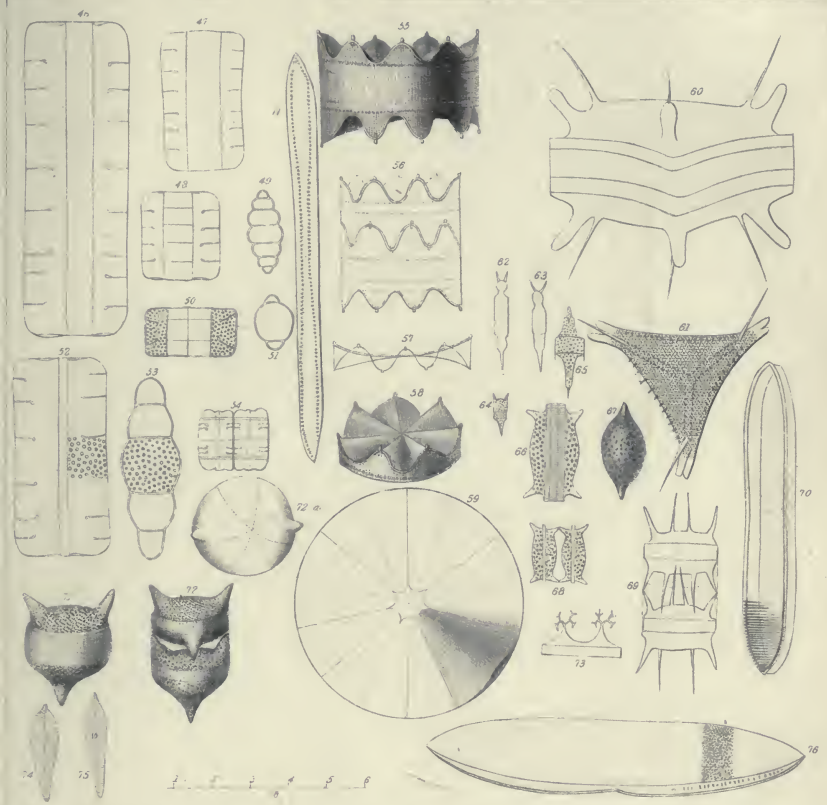
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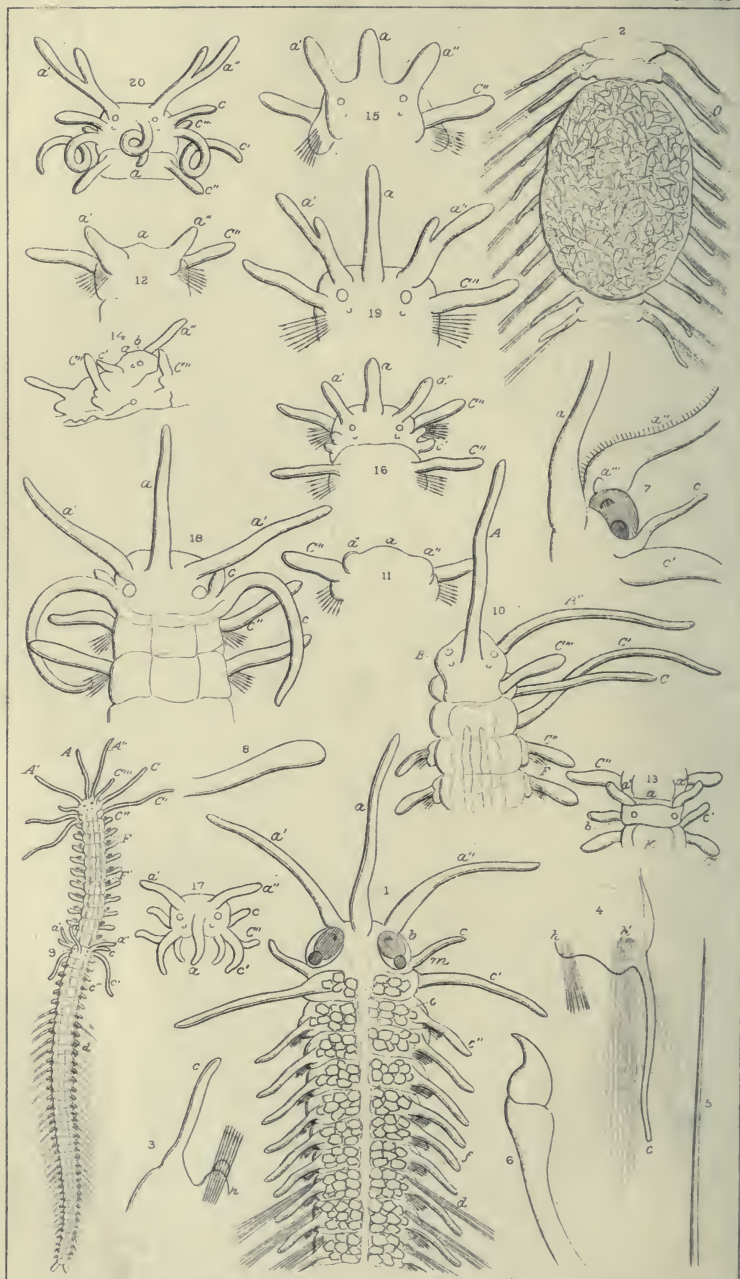


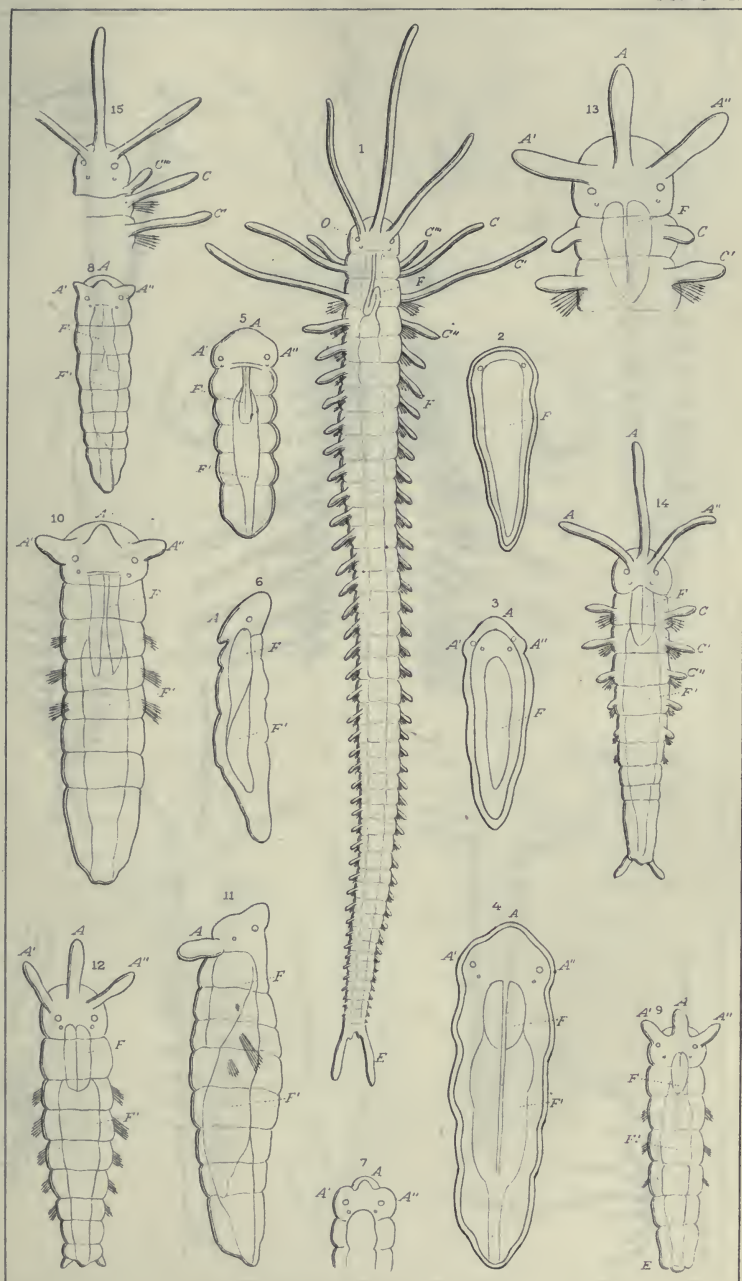






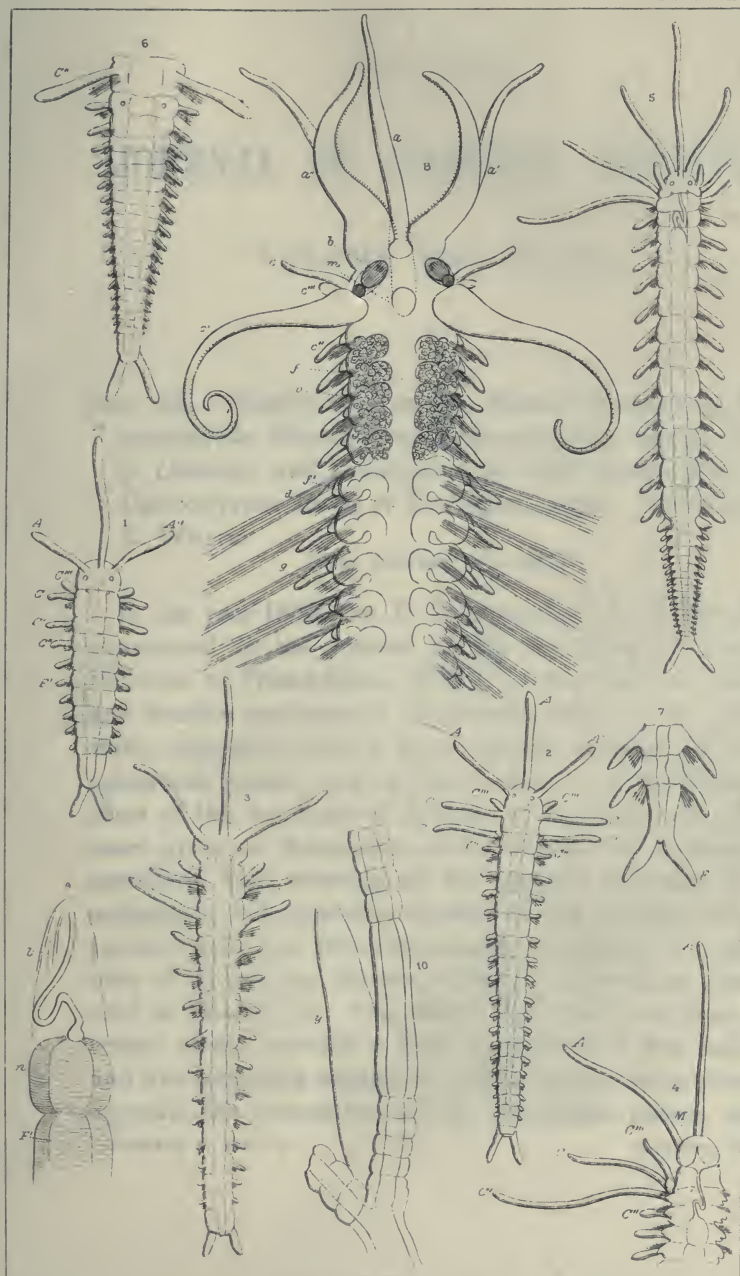














B O S T O N

# JOURNAL OF NATURAL HISTORY.

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ART. IX.—*Observations on the Summit Structure of Pentremites, the Structure and Arrangement of certain Parts of Crinoids, and Descriptions of New Species from the Carboniferous Rocks at Burlington, Iowa.* By CHARLES A. WHITE.

[Read February 5th, 1862.]

IN the year 1850, Drs. D. D. Owen and B. F. Shumard announced in the Journal of the Academy of Natural Sciences of Philadelphia, (Vol. II. p. 65,) that the mouth and ovarian apertures of *Pentremites* were, in the perfect state, completely closed by a conical covering of small calcareous plates; and in Vol. I. No. 2, of the Transactions of the Academy of Science of St. Louis, Dr. Shumard gives an illustration of the summit of *Pentremites conoideus*, Hall, showing all the summit apertures to be completely and separately covered in the manner referred to, and makes the following remarks in relation to a specimen of *P. sulcatus*, Rømer, which Prof. Swallow discovered at Chester, Ill. "In this fossil, there rises from the centre of the summit a little pyramid with five salient, and five retreating angles, the salient angles being directly opposite the extremities of the interradian pieces, while

the retreating angles correspond to the centres of the pseudambulacral fields. The base of this little pyramid is joined to the superior edges of the pseudambulacral fields, so as to completely roof in the buccan and ovarian apertures. It consists of about fifty pieces, arranged in ten series; the first, or, exterior ones, in each series, being of a triangular form, the others elongated, quadrilateral. Two series of pieces stand over each ovarian aperture, those of one side uniting with their fellows of the opposite side at the salient angles of the pyramid."

Dr. Shumard further expresses the opinion that all the summit openings of *Pentremites* were closed, and in the second Missouri Report again remarks,—"I have but little hesitation in advancing the opinion that all the *Pentremites* included at present in the group *elliptici* of Rømer will be found like *Eleacrinus* deficient in a central summit opening."

The difference in the character of these summit coverings which Dr. Shumard has shown to exist in the same group (*floreales*) is remarkable, but may not have been inconsistent with a similarity of structure of other parts. The following observations also show much diversity in the structure of the superior parts of different species of the group *elliptici*, yet all seem to differ materially from those of the *floreales*.

Besides the numerous examples which my own cabinet affords, I have been favored with access to the extensive collections of Rev. W. H. Barris, Mr. Charles Wachsmuth, B. J. Hall, Esq., and Dr. Otto Thieme, of Burlington, Iowa, which enables me to add to the foregoing interesting observations of Dr. Shumard the results of my own upon the summit structure of the following well-known species of *Pentremites*, as well as further observations on the structure of certain parts of Crinoids.



## PENTREMITES NORWOODII Owen and Shumard.

The interrarial pieces of this species are small, and so arranged that they join each other at the sides of their upper ends, being separated from each other through the greater part of their length by the interposition of the pointed ends of the lancet pieces, and slightly truncated at the upper ends, leaving a subpentagonal aperture which is probably reduced in size by the insertion of other small plates, and is also covered by an integument of small plates which will be presently noticed.

Within the body, along the sides of each of the lancet pieces, at the termination of the pores, run shallow grooves, which terminate in the so-called ovarian apertures. These apertures are five in number, including the anal aperture, and are pierced through the solid substance of the interrarial plates, the perforations dividing within the substance of the plates; each communicating with two of the forementioned grooves, one from each of the adjacent rays; and are, except the anal aperture, prolonged above into small, rather short, tapering, erect or converging tubes. These tubes are not composed of small plates, but are integral parts of the interrarial plates, and being very thin at their upper ends, their condition seems to render it doubtful if their apertures ever possessed a plated covering.

The anal aperture is larger than the others, into which one of the so-called ovarian apertures from each of the adjacent rays opens, and is bordered on the outer side by a solid projection of a part of the interrarial plate, of about the same size and height as the forementioned tubes.

The pseudambulacral fields are composed of the analogues of the different elements of the corresponding parts in the typical group of *Pentremites*, but in common with all the *elliptici*, they present some important modifications. The poral pieces, and supplementary poral pieces are small

and prominent, and occupy narrow, angular grooves between the median ridge of the lancet pieces and the edges of the radial plates. The poral pieces of each side of the field are adjacent at its lower end, but are separated at the upper part of the field by a space about equal in width to that occupied by each row of poral pieces. The poral pieces projecting a little above the median ridge of the lancet pieces, leaves a narrow groove along the centre of each pseudambulacral field, which comes to a point at the lower end.

The whole central space between the summit tubes and the anal aperture, which is rather small, is overlaid with an integument of microscopic plates, entirely covering the central aperture, passing out between the bases of the tubes in a double series of plates, and was evidently continued far down the central grooves of the pseudambulacral fields, causing the crenulated appearance of those parts usually observed there, so that when perfect this integument was of a very sharply stellate form, the component plates being closely connected throughout, and so small that a space of half a line square contains over thirty of them. They are prominent and distinct, but are somewhat irregular in size and arrangement. A fine hair-like groove runs along the centre of each lancet piece, and passes beneath the rays of the plated integument, the plates of which arch over it. No specimens which we have examined show a plated covering to the anal aperture, but it can hardly be doubted that it really existed.

One cannot pursue these detailed examinations of structure without awakening the inquiry, — what office did each of these various parts perform?

Of the summit apertures of *Pentremites* it has been heretofore considered as certain that the central one was the mouth, and that the others were ovarian apertures, the larger of which was also the anal aperture.

The structure of the summit covering of *P. Norwoodii*, just described, would seem to render it quite improbable that the central aperture was the mouth ; which being the case, we are obliged to consider the aperture usually regarded as the anal opening as also the buccal aperture, and in addition to this, in this species, it must have also served as the vent of two of those canals which end in the so-called ovarian openings ; which arrangement would seem to be more complicated than their known position in the scale of organization would seem to indicate ; and to regard those summit openings as ovarian apertures does not seem consistent with the knowledge we have of the mode of deposit and dispersion of the ova of crinoids, with which these animals are so closely allied.

It seems at least probable that the so-called ovarian apertures performed a far simpler, but scarcely less important function, — that of apertures of siphonal tubes for the vibration of the tentacula, by the injection and expulsion of water ; communicating, by way of the tubular apparatus beneath each pseudambulacral field, with each tentacle through the pores, expanding them by the inflation of the tubular canal along their inner grooves, and contracting them by the expulsion of the water. It is conceived that this operation of the siphonal tubes would produce all the necessary motion of the tentacula, and be more in accordance with the status of the animal than a complex muscular system, which would otherwise be necessary to operate the hundreds of those minute organs.

Moreover, if the tubular openings of this species are to be regarded as ovarian apertures, it will be necessary, as before remarked, to disregard the close analogy of these animals with the true crinoids, in which the ova are developed in little accessory sacs at the base of each tentacle, between which organs and the summit tubes of this



species there is no connection, and apparently no indication that any ever existed.

It seems more probable that as the ova were germinated within the body, they found their exit through the central summit aperture, and were conveyed along the small central grooves of the pseudambulacral fields, before mentioned, beneath the plated integument, to the bases of the tentacula, where they were developed and discharged, as in the true crinoids.

With the exception of the union of each pair of the so-called ovarian apertures, and their tubular prolongation, as in this species, there is reason to believe that all the known species of the group *elliptici* had essentially the same summit structure, and which does not appear to be analogous to that of the *floreales* in any of their known modifications. The following observations, however, will show that essentially the same summit structure was possessed by *Pentremites stelliformis* Owen and Shumard, although it differs materially from all the *elliptici*, and should be assigned to a group which would probably also include *P. sirius* White.

PENTREMITES STELLIFORMIS Owen and Shumard.

Well-preserved specimens of this species show all the summit apertures to be closed by minute polygonal plates, unless we except a narrow slit on each side of the superior end of the pseudambulacral fields, which are directed downwards along their outer margins, and are somewhat overlapped by what appears to be a greater development of the poral pieces in these parts of the fields, where they are considerably wider than at the extremities. These slits may have served the same purpose as the ovarian or siphonal apertures in other *Pentremites*.

The anal aperture is completely closed by a disk of minute polygonal plates, which in the specimens exam-



ined is a little below the plane of the general surface. These plates are so small that the number covering an aperture of half a line in diameter is eighteen or twenty. Their size and arrangement are somewhat irregular. The lancet pieces are apparently longitudinally perforate, and rest in broad grooves in the radial plates, at their outer ends. A narrow groove runs along the centre of the upper side of each. These grooves meet together at the summit aperture, and are bordered on each side by the poral pieces. They are neatly filled by a compound series of minute plates, which closely connect at the summit with five small plates, arranged like a five-pointed star, with the points touching each of the upper ends of the inter-radial plates, thus completely covering the summit aperture which weathered specimens show to exist beneath, formed by the slight truncation of the interradi al plates. The stellate series of five plates at the centre being an integral part of the integument which fills the grooves, with their position, forbids the supposition that they were a movable covering for the mouth, which evidently was not situated here, but in the same aperture with the anus. The filling of the central grooves of the pseudambulacral fields, and the covering of the central summit aperture, are essentially the same in this species as in *P. Norwoodii*, and doubtless served the same purposes, as previously suggested.

This species, as before remarked, is not properly referable to any of the groups established by Dr. Rømer, but in some respects approaches *Codaster*; more, however, in its summit apertures than its resemblance to the Carboniferous forms of that genus.

If the suggestion that the thin slits near the summit, on each side of the pseudambulacral fields, are equivalent to the ovarian or siphonal apertures of other *Pentremites* is correct, it may not prove fruitless to look for similar ones

in *Codaster*, as all the Blastoids are possibly too nearly related to admit of such differences from the true *Pentremites* as are supposed to exist in *Codaster* and *Eleacrinus*.

PENTREMITES LINEATUS Shumard.

A specimen of this species, with the tentacula attached, shows these appendages to be long, angular, and slender, composed of short joints in single (?) series; those originating at the lower end of the pseudambulacral fields being about as long as the length of the body from base to summit; all of them directed upwards, and lying close together above the summit in the form of a hair pencil. The condition of the specimen is not such as to show the connection of the tentacula with the poral plates.

PENTREMITES ELONGATUS Shumard.

A crushed specimen of this species, with the tentacula remaining in place, shows their arrangement to have been similar to that of *P. sulcatus* of Rømer, as represented in his "Monographie der fossilen Crinoidenfamilie der Blastoideen," and which was doubtless similar in all the *flo-reales*. In this species they are proportionally longer than they are represented in *P. sulcatus*, extending above the summit a distance equal to one third the height of the body. They appear to connect directly with the supplementary poral pieces, and to abut closely against the edges of the radial and interradial plates. They are directed obliquely toward the centre of the pseudambulacral field, for a short distance, and are then bent directly upward, and lie side by side, neatly filling the field.

The condition of the specimen under examination will not admit of ascertaining their structure with accuracy, but they appear to be composed of a double series of short, angular plates, with parallel sutures, so arranged that the sutures between the plates of one series are oppo-

site the middle of the plates of the other series. No indications of ciliated appendages to the tentacula have been observed.

*Observations on certain modifications of the structure of the probosces of Actinocrinus.*

Although the Carboniferous limestones of the West have yielded such great numbers of crinoids in a good state of preservation, belonging to numerous genera and species, it is to be regretted that so little light has been thrown upon their animal economy, in addition to that which has long been known.

Most fossil crinoids evidently possessed but a single opening,\* usually called the anal aperture, yet separate anal and buccal apertures and tubes have been noticed by European authors, but so far as I am aware, the following are the only instances of their recognition in specimens from American strata, if we except the *Blastoidea*, which, however, should not be excepted in all cases, if the conclusions recorded on a previous page are correct.

A specimen of an *Actinocrinus*, apparently *A. Verneuilianus* of Shumard, shows two strong plated tubes, each having the structure of the proboscis of *Actinocrinus*, protruding from each side of the mass of its folded arms. To make sure that the connection between them was complete, the specimen was ground off so as to show the junction in the most perfect manner.

The height of the body to the base of the proboscis is

\* That the single aperture of *Platycrinus* and other genera contained both the buccal and anal openings there can be no question. The apparent inconvenience of such an arrangement is shown by the not uncommon discovery of the shell of a *Platyceras*, inverted over the aperture, closely clasped by the arms of the crinoid, which had evidently died before devouring the contents of the shell. If the animal had lived to consume the food thus secured, the shell would certainly have been much in the way of a proper performance of other functions. The idea that the Gasteropod was the attacking party seems untenable, from the fact that the family are all regarded as vegetable feeders.



about seven lines ; from this to the central point of divergence, about two and a half lines ; and from the latter point to the end of one of the branches, twelve lines. The other branch was apparently about the same length, but is broken. The two branches are of about equal size ; the diameter of each just above the point of divergence being about the same as that of the main tube or proboscis below that point, which is there about the usual size.

Another specimen of the same genus, but of an unascertained species, showing only the upper part of the dome, measures one inch from the base of the proboscis to the point of junction of the two diverging tubes. These are both broken ; but what remains indicates that they were each about an inch in length, of equal size, which is about half that of the main tube just below the junction, where a cross section would be elliptical. The main tube, or proboscis, is of about the usual size at the base, but it gradually enlarges towards the junction, by the irregular interposition of numerous small plates between the larger ones.

I am not fully satisfied that these instances are not both the result of accidental development. The manner of divergence of the tubes, it is seen, is not quite the same in both cases, though it is probable that the specimens belong to different species. The interposition of the small plates in the structure of the lower part of the tube in the second instance has the aspect of being abnormal. This, with their rare occurrence, and the supposition that the former specimen belongs to the species *A. Verneuilianus*, which is known to have a long, single proboscis, would seem to indicate that they were so, at least to some extent.

This view may have a still further corroboration in the following instances, as well as the known recuperative powers of the crinoidea, in sustaining and repairing inju-



ries, even to the addition of a greater than the normal number of plates. It should, however, be remarked, that each branch of the proboscis, in both these instances, is as perfectly and regularly formed as any single proboscis.

Whether this division of the proboscis is normal or abnormal, we may be sure that one of the branches was the buccal and the other the anal tube; but which performed the first, and which the latter office, there seems to be no means of ascertaining.

Two instances have been observed of a small tumid projection on the side of the proboscis of *Actinocrinus*, near the upper end, above the reach of the arms; which has suggested the idea that an aperture at this point, now closed, connected with the anal canal; however, these may be only obstructions of the tube.

*Instances showing the recuperative power of crinoids.*

The remarkable recuperative power of the crinoidea is shown in the following instances, observed among the collections at Burlington.

1. Two specimens of *Pentremites Norwoodii* have lost each an entire side, leaving the bodies quadrangular, but scarcely affecting their symmetry, and what is most remarkable, one of the pseudambulacral fields of each specimen contains two complete sets of poral and supplementary poral pieces. The specimens are of full average size, notwithstanding their loss, from which they seem to have suffered little inconvenience.

2. Three calyces of *Platycrinus* of different species are found to have lost each a first radial. The calyces are quite symmetrical, and composed of only four plates each, resting on a quadrangular base.

3. Two specimens of *Actinocrinus* are found with an entire ray wanting in each; the remaining parts forming a perfectly symmetrical body of only four rays, which

shows no indication of which ray has been removed, and each preserving their well-known specific characters.

4. A specimen of the type of *Actinocrinus umbrosus*, Hall, has two deep incisions, one on each side, directed towards the centre, entirely dividing the brachial disk, reaching downward about half the height of the body, and their upper ends approaching each other at the centre of the dome, with only a distance about equal to the diameter of the proboscis intervening. These incisions, instead of healing in such a manner as to restore the natural surfaces, seem to have widened by sloughing, and finally healed, having the injured surfaces completely incrustated with an integument of small plates. The other parts of the body are all well developed, and the animal seems to have lived in perfect health after its wounds were fully healed.

5. Several instances have been observed where parts of several adjacent arms in *Platycrinus*, *Actinocrinus*, and *Poteriocrinus* have been broken off nearly as far down as the primary radials; the animals dying before their entire replacement, we see miniature duplicates of the lost parts sprouting from the broken ends, perfect in every part, and evidently wanting only time to become as good, and perhaps as large, as the lost ones were.

6. A specimen of *Rhodocrinus* is found to have lost all the arms of two rays, which were removed at their point of junction with the body, and the parts have been healed in such a manner as indistinctly to show the place where they were formerly attached.

7. Instances are very common of the loss of more or less of the simple arms of *Actinocrinus*, and the healing up of the apertures thus left; the parts often being closed so neatly as to leave no indication of the loss having occurred, except the want of conformity of the ray or

division of the ray in which it occurred, with the corresponding ray or division in the same or other specimens.

Such losses are most common in the more globose species, and sometimes cause considerable difficulty in determining the normal number of arms to each ray, the variation of which is often the principal difference in closely allied species, at least so far as the usual conditions of their preservation will allow us to determine.

No instances have been observed of the replacement of the brachial appendages when amputation occurred in close proximity to the body, or principal rays, which is taken to indicate the probability that the power to reproduce lost parts did not extend to the principal rays and the body; yet their power of sustaining and recovering from severe injuries is most remarkable. It is most probable, however, that those instances of the want of an entire side, or ray, are the result of embryonic deficiency, or possibly occurred while the animal was young, and in a vigorous stage of growth.

8. A specimen of *Actinocrinus rusticus*, Hall, has an extra plate developed between two of its first radials, making the interrarial series in which it occurs greater than the others, and equal to the anal series, and presenting a series of seven plates of about equal size, surrounding and adjoining the basal plates. This is probably not the result of an injury, but is given as a probable case of excessive embryonic development, and in contrast with the supposed embryonic deficiencies in some of the previous cases.

9. Different parts of the body and column of crinoids are frequently found, showing evidences of having suffered a disease of the exterior surface. The genus *Cyathocrinus* has been found thus affected, but *Actinocrinus* and *Platycrinus* seem to have suffered most, especially the latter.

The characters of the traces of this malady are essen-



tially the same as those described by Messrs. De Koninck and Le Hon, on page 61 of their excellent "Recherches sur les Crinoïdes du Terrain Carbonifère de la Belgique," which is thus translated:—"The genera *Actinocrinus* and *Platycrinus* often show considerable traces of a malady which has the appearance of having been caused by some parasitic animal. They are circular, shallow holes, terminating in a rounded fosset, and distributed at hazard over the plates of the body or the column. Around the holes the substance of the plate seems to be raised or tumid, in a manner circumscribed by a more or less prominent ridge. This kind of excrescences may occasionally attain a considerable development, assume the form of globose appendages perforated at the centre, and deform certain parts of the body or column."

Several specimens of *Cyathocrinus cornutus*, Owen and Shumard, have been found with one or more broad, shallow excavations in the substance of the plates, usually the first radials near the junction of the arms. These cavities are quite different from those previously mentioned, and have the aspect of having been dissolved out, and do not present the evidence of recuperative action that the others do.

Although the arrangement of the plates composing the calyx of the crinoidea presents us in many cases with definite generic characters, and though the formulas of these plates have heretofore been almost exclusively used in their classification, it has been long understood that in some instances there were excellent generic characters presented in the mode of construction of the parts above the calyx; yet these have not generally been available, either for generic or specific distinctions, on account of the imperfect condition in which they were generally found.

In the large collections lately made, it is not uncommon



to find specimens usually referred to the same genus, differing materially from each other in the construction of their superior parts, when the structure of their separated calyces gives no indication of generic differences, and in some cases approaching each other so nearly as to make it necessary to use the superior parts exclusively for specific distinction. This difficulty is very great in the classification of the *Platycrinidæ*, and still greater in the *Cyathocrinidæ*. Although the structure of the calyx in the latter family is not so simple as that of the former, yet it proves to be incapable of giving expression to the numerous generic and specific characters which the family is known to include.

No instances of a greater number than two primary radials to each ray of *Platycrinus* have been observed; yet beyond this there are modifications in different species which seem to be of even more than specific importance. These, however, until lately, have been seldom seen; and relying on the modifications of the calyx alone, it is to be feared that species have heretofore been founded upon what are really only individual variations, and that in other cases the descriptions were necessarily so meagre that they would apply to specimens which their accompanying arms, discovered after the descriptions were published, prove beyond question to belong to different species, although no one would have been justified in regarding them as distinct, upon an examination of their calyces alone. The same remarks are equally true of the other more prominent genera.

It is also equally true that genera have been founded upon a misconception of characters, and science has been burdened thereby with synonymes; but discoveries of more and more perfect forms of these fossils seem to indicate as plainly the propriety of establishing new genera, as the necessity of abandoning some of those which have been proposed.

The restriction of the number of primary radials to two, in *Platycrinus*, seems to be a natural one; but all the genera of the *Cyathocrinidæ*, as now constituted, except one or two lately established upon the characters of the superior parts, are variable in the number of primary radials to each ray. The genus *Cyathocrinus*, as defined by De Koninck and Le Hon, is restricted to three primary radials to each ray; yet we find the number in *C. rotundatus*? Hall, to vary in the different rays of the same specimen; their number on the anterior ray reaching seven or eight, and all the others having more than three. In *C. viminalis*, Hall, there are four primary radials to each ray, and in *C. divaricatus*, Hall, the anterior ray alone has four, while the others have three primary radials. The other characters of all these species plainly correspond to the typical forms of *Cyathocrinus*.

In *Poteriocrinus* and *Scaphiocrinus* the number of primary radials to each ray has been regarded as of only specific importance, yet in the latter genus there are usually but two primary radials, with an occasional addition to the number in the anterior ray. All the species of *Zeacrinus* yet described, with their superior parts, have but two primary radials to the lateral rays, the anterior one having more; the number being variable in different species.

If these facts do not show the necessity of a greater generic restriction of the number of primary radials to each ray, they seem to prove that generic distinctions really consist, to some extent, of characters which human language will fail to convey a definite idea of, but which must be comprehended by careful and numerous comparisons. Those who have studied the crinoidea will probably not regard the latter proposition as altogether unreasonable.

A general recognition of the generic value of the structure of the superior parts of crinoids, would doubtless

cause the necessity of generally regarding the more prominent modifications of the inferior parts as family distinctions. Indeed in a few cases, even a limited number of the component plates of those parts will indicate as clearly the family as the generic relations. For instance, while a pentagonal, tripartite base of unequal parts will give no indication whether it belonged to a *Platycrinus* or a *Mespilocrinus* — two genera belonging to widely distinct families — yet a tripartite base connected with sub-radials indicates with precision, so far as our present knowledge extends, that the specimen belongs to a family which should include *Forbesiocrinus* and *Mespilocrinus*;\* and a tripartite base supporting five radials and an anal plate, as clearly indicates the specimen to belong to the great family of *Actinocrinidæ*.

These, however, are exceptional cases, and if modifications of the present system of classification should be proposed, we shall doubtless find it as desirable to possess perfect specimens, to enable us fully to understand their family, as their generic or specific characters.

A recognition of the generic value of the structure of the superior parts of crinoids has been made by authors in the establishment of the genera *Bursacrinus*, Meek and Worthen, *Pterotocrinus*, Lyon and Cassady, *Trematocrinus*, Hall, etc. Going beyond this, Prof. Hall has established two sub-genera — *Homocrinus* from the Silurian, and *Scaphiocrinus* from the Carboniferous rocks; and the lamented Troost left us the generic description of *Zeacrinus*

\* These two genera, founded by De Koninck and Le Hon, were not assigned by those authors to the same family; the propriety of which is apparent since the modification of the formula of *Forbesiocrinus* by Prof. Hall. A striking feature common to both these genera is the want of any indication that the upper part of the body was covered with a plated integument, as is the case in most other fossil crinoids, but that these parts were in some cases protected by the folding together of the arms, or their analogues. This peculiarity was doubtless also possessed by *Ichthyocrinus*, although its formula is quite different from either of the others; which fact will debar its use as a family character.



from the latter rocks, with his views concerning the propriety of its establishment. These genera appear to be founded, not upon detailed distinctions from *Poteriocrinus*, as these authors found it constituted by Miller, but upon the definiteness of the *ensemble* which a collection of the species of each genus presented to the eye, with a constancy of form and inflection in some of the parts of each. The peculiar external expressions of these genera were doubtless accompanied with as great, if not greater, modifications of internal structure, not now available in their classification; but they are scarcely less important if considered as only expressions of chronological characters in the mystic language of organic forms.

That there is great difference in the perspicuity and practical value of generic characters is quite apparent; but we cannot admit that there is really a gradation from specific to generic and family characters; and the actual existence of sub-genera may even be doubted, although our present mode of classification seems to require their recognition.

The investigations of the past few years having resulted in bringing to light so many nearly perfect forms of fossil crinoids, which have added so much to our knowledge of the various modifications of the structure of their superior parts, and so plainly shown the impropriety of referring such varied forms to the same genera, the time seems to have arrived for a more full recognition of the generic value of these modifications. I therefore propose for a group of these fossils, of which *Poteriocrinus dilatatus* of Hall is the type, the generic name of *Cæliocrinus*, to be used in at least a sub-generic sense.



## CÆLIOCRINUS (n. g.)

Etym. κοιλία, *venter*; κρίνον, *lilium*.

*Generic formula and description.*

Basal pieces, 5.

Subradial pieces, 5.

Radial pieces,  $5 \times 2$ , subequal in size.

Anal pieces, 4 or 5 visible when the arms are in place.

Arms 10, bifurcating once or more, and composed of single series of pieces, with obliquely alternating, or parallel sutures.

It will be seen that the above formula contains nothing that the formula of *Poteriocrinus* would not include, but that it is more restricted. Compared with *Scaphiocrinus*, with which it is associated, the entire specimens are proportionally much shorter, more robust, the ventral sack much larger and more expanded than the inflated probosces of some species of *Scaphiocrinus*, which occupy a similar position. The species now known have not the bent or corrugated body-plates, nor the constricted arm-plates so common in that genus. The prominent features of this genus are, First, The large inflated ventral sack, varying in size in different species, from four or five times the capacity of the calyx, to ten or twenty times that capacity. It is widest at the top, in some cases extending above the tips of the arms,—the lower part being contracted between the arms like the neck of a balloon,—and joins by this to the anal series.

Second, The proportionally small calyx formed by the basal, subradial, radial and first anal plates, which is so small as to render it certain that it could not contain the necessary internal organs for the support of the other parts. These organs must have been located in the plated sack, which I have denominated the *ventral sack*; thus reversing

their usual order of operation, as the mouth was doubtless at the side of the neck, near the base of the arms. This aperture, however, has not been observed, although a separated sack of *C. dilatatus* has been carefully examined, together with more than half its neck, without the discovery of any aperture whatever, and four plates of the anal series seen, with no better result.

Other peculiarities of all the species at present known, are, — the primary radials are only two in number to each ray; each of the second radials supports two arms, which are composed of from four to ten joints to the first bifurcation, which are subcylindrical, and lie folded against the neck of the ventral sack.

The joints of the upper parts of the arms in one species do not reach quite across, but alternate in such a manner as to give somewhat the appearance of a double series.

The column of all the known species is round, and composed of thin joints of nearly equal size; and the surfaces of all the plates, except those of the sack, are without ornamentation, and the sutures are not impressed. The anal space is rather wide, and the series of plates, so far as seen, consists of a double, alternating series, the first plate resting in the retreating angle between two of the subradials, and the second, on the upper truncated side of one of these subradials.

The plates of the ventral sack are rather small, tumid at the upper part of the sack; and in two species they are radiately ridged. Some separated parts of these sacks show the plates arranged in somewhat regular rows, which pass over the top, from side to side, their arrangement being more confused on the two opposite sides; yet the symmetry of the sack does not seem to be affected by the disposition of the plates.

Should these peculiarities prove to be of generic im-

portance, as many of them appear to be, the specific distinctions will be principally confined to the variations in the general shape, the mode of bifurcation of the arms, and the form and arrangement of their joints, and the form, arrangement, and ornamentation of the plates of the body and the ventral sack.

The three species of this genus at present recognized are the *Poteriocrinus dilatatus*, and *P. ventricosus*, of Hall, and *Cæliocrinus subspinosus* herein described, all from the Burlington limestone.

*Cæliocrinus subspinosus* (n. s.) Body small, broadly expanding; basal plates small, showing minute pentagonal, or subtriangular faces beyond the margin of the column; subradials of moderate size, about as wide as high, three hexagonal, and two heptagonal; first radials a little larger, and more massive than the subradials; they are rather prominent above, where they are separated from each other by moderately deep sutures; second radials larger than the first, the anterior and posterior ones larger than the other two. The arms bifurcate but once or twice, the second bifurcation being so near the ends of the arms as to be liable to be broken off. The first four anterior arms bifurcate on the tenth, and the other six on the eighth joint from the second radial. Surface of the body and arms without ornamentation, the latter rounded, or subcylindrical. The column moderately strong, round, and composed of thin plates of nearly equal size. The ventral sack, which reaches nearly as high as the arms, is proportionally smaller than in *C. dilatatus*, and *C. ventricosus*. The top, which is the only part distinctly visible in our specimen, is flattened, the plates composing it not very numerous, tumid, and four or five of them at the margin are produced into short, diverging spines. The arrangement of the anal series is the same as mentioned in the generic description.



Two conspicuous features of this species are its spinose ventral sack, and the great proportional length of the arms to the first bifurcation, which is equal to, or more than half the entire height of the specimen, from the base to the summit of the sack.

*Locality and position*, in the upper division of the Burlington Limestone, Burlington, Iowa.

*Collection of Mr. Charles Wachsmuth.*

Genus PLATYCRINUS Miller.

*Platycrinus verrucosus* (n. s.) Body of medium size, deeply cup-shaped, about as high as wide; base broadly convex; facet for the attachment of the column moderately large and circular, or subcircular; first radials higher than wide; articulating facets of the arms shallow, wider than high, occupying about half the width of each first radial plate; second radials very small, not occupying the full width of the facets, the arms bifurcating immediately upon this, with only one plate intervening between the first, and each of all the other bifurcations. Arms moderately large and long, composed of a double series of joints; tentacula numerous and strong.

Surface marked by somewhat scattered, prominent, wart-like nodes, elevated abruptly from the surface of the plates, sometimes coalescing, and having a tendency to arrange themselves in rows parallel to the sutures, and on the first radials a part of them being often arranged in two rows, diverging from the base of the arms to each of their lower angles. The arm-plates between the first and last bifurcations are somewhat tumid, but the arms themselves are without ornamentation, except fine granulation. Column subcircular at the top, but rapidly increasing in size from the body, assuming a twisted oval shape. This species has been referred to *P. Yandelli* of Owen and



Shumard, previous to the discovery of the arms of both species. It differs in the greater proportional height of the calyx, the character and arrangement of the nodes, and the mode of bifurcation of the arms.

*Locality and position*, in the lower division of the Burlington Limestone, Burlington, Iowa.

*My own Cabinet and that of Mr. Charles Wachsmuth.*

*Platycrinus incomptus* (n. s.) Body cup-shaped, gradually expanding from the base, which is rather broad, more or less depressed in the centre, and considerably bent up at the sides; suture-lines much depressed, those between the base and first radials sometimes so much so as to give the base the appearance of being protruded; arm-facets sub-semicircular, occupying about one half the width of the first radials; first radials higher than wide, full in the central parts; second radials very short, some of them not quite filling the facet in the first radials; first division of the rays consisting of two plates each, abutting against each other by their inner ends; upon the second of these, the second divisions take place, which are composed of the same number of plates as the first, and abut together in the same manner; other divisions take place, with the same number of plates intervening; as near as can be ascertained, seven or eight arms to each ray. The arms beyond the last bifurcation are rather short and small, but between the body and the last bifurcation, they are quite robust. The dome is rather high, covered with tumid plates, small, except five at the centre, which are larger, and arranged with their longest diameters directed to the anal, and each interradian space, all meeting together at the summit; the one over the anal space is the largest, the anal aperture being situated about half way between it and the top of the calyx. Surface without ornamentation.

The calyx of this species somewhat resembles, and was

referred to *P. Burlingtonensis*, of Owen and Shumard, before the discovery of the arms of both species; but it differs in being constantly much larger, and proportionally higher; the plates of the dome are more numerous, and differently arranged; the arms more numerous, and have a different mode of bifurcation.

*Locality and position*, in the upper division of the Burlington Limestone, Burlington, Iowa.

*In my own Cabinet, and those of Rev. Mr. Barris and Mr. Wachsmuth.*

Genus CYATHOCRINUS Miller.

*Cyathocrinus lamellosus* (n. s.) Body rather small, subglobose; base depressed; basal plates very small, nearly covered by the last joint of the column; subradials of medium size, about as high as wide; first radials about the same size as the subradials, wider than high; first anal plate, fully half as large as the subradial upon which it rests. The condition of our specimen does not show clearly the number of primary radials to each ray, but they were four, or more in some of the rays.

Surface marked by high, sharp, radiating ridges, diverging from the centre of each subradial plate to those adjoining it. These ridges are five in number on each subradial, except the one beneath the first anal plate which has six, one of which connects with a perpendicular ridge on the first anal plate, on which plate it is crossed at right angles by a similar ridge. There are two ridges on each first radial plate, which converge at the arm-bases, and are continued in a sharp ridge on the back of each arm and branch, to the ends. The ambulacral grooves along the inner side of the arms and branches, are deep, leaving a thin edge on each side, which, with the sharp ridge on the back, gives a sharp V-shape to a cross section.

Column rather small, round, and composed of thin joints, alternating in size.

This species has an appearance quite unlike any other with which it is associated.

*Locality and position* in the upper division of the Burlington Limestone, Burlington, Iowa.

*Collection of Rev. W. H. Barris.*

Genus SCAPHIOCRINUS Hall.

*Scaphiocrinus rusticellus* (n. s.) Body moderately small; base comparatively broad, full half as broad as the top of the calyx; rather deep depressions at the suture angles of the body plates, except those at the lower angles of the subradials, at the junction of the basal plates. At a point on the column about as far below the base as the height of the calyx, there is a joint wider than the others, below which the column is roughly pentangular, and above which it is pentalobate, and increases so rapidly in size to the base that the sides of the calyx and the column are nearly on a line with each other. The lobes of each part of the column continue up to, and include the subradials, the depressions between them ending at the lower ends of the first radials. The column is composed of thin joints alternating in size so as to give the lobes a nodose appearance. Basal plates moderately large, appearing beyond the column in subtriangular, excavated faces; subradials of moderate size, the sides being very short, gives them a subquadrangular appearance; first radials larger than the subradials, a little wider than high, having depressed sutures between them; second radials larger than the first, a little higher than wide, except the anterior one, which is a little shorter than the others; these are rather robust, and a little constricted just below their upper ends. These support two arms each, but the condition of our specimen

will not satisfactorily show the other divisions. The arms are composed of angular, cuneiform plates.

This species somewhat resembles *S. Whitei*, of Hall, but differs in its more robust form, the proportions of the parts, the pentalobate and expanded stem, and in the second radial of the anterior ray being shorter than the others, and not longer, as in that species.

*Locality and position* in the lower division of the Burlington Limestone, Burlington, Iowa.

*Collection of Mr. Charles Wachsmuth.*

ART. X.—*Descriptions of the Fossil Plants collected by Mr. George Gibbs, Geologist to the United States Northwest Boundary Commission, under Mr. Archibald Campbell, United States Commissioner.\** By Dr. J. S. NEWBERRY.

[Read October 1, 1862.]

THE fossil plants collected by the Boundary Commission on Vancouver's Island, Orcas Island, and on the coast of Washington Territory, at Bellingham Bay, &c., form a most interesting addition to the representatives which we had before received of the extinct floras of the cretaceous and tertiary strata of Northwest America.

Previous to the arrival of this collection, a considerable number of fossil plants had been obtained from this region by Prof. J. D. Dana, Geologist to the United States Exploring Expedition, under the command of Captain Charles Wilkes; and by Dr. John Evans, United States Geologist of the Territory of Oregon.

Of the first of these collections, a brief notice was given

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by Prof. Dana, in the "Geology of the Exploring Expedition," and several of the species were figured in the atlas accompanying that work.

The collection made by Dr. Evans, was by him committed to Mr. Leo Lesquereux, the well-known fossil botanist, who published descriptions of fourteen species in the "American Journal of Science," Vol. XXVII., (2d series,) p. 359. Of these, five were from Nanaimo, Vancouver's Island, viz.: *Populus rhomboidea* (Lesqx.), *Quercus Benzoin* (Lesqx.), *Q. multinervis* (Lesqx.), *Q. platinervis* (Lesqx.), *Ficus* sp., *Cinnamomum Heeri* (Lesqx.), with which are enumerated, but not described in full, "a *Platanus* with the same nervation as *Quercus platinervis*," "a *Chamærops* agreeing with *Sabal Lamanonis* Brgh., common in the European Miocene," a very fine *Salisburia*, very variable in the outline of its leaves, and named *Salisburia polymorpha* (Lesqx.) and "a small piece of a fern referable to the genus *Lastrea*."

From Bellingham Bay, Mr. Lesquereux describes *Salix Islandicus* (Lesqx.), *Quercus Evansii* (Lesqx.), *Quercus Gaudini* (Lesqx.), *Planera dubia* (Lesqx.), *Cinnamomum crassipes* (Lesqx.), *Persoonia oviformis* (Lesqx.), *Diospyros lancifolia* (Lesqx.), *Acer trilobatum*? (Al. Br.).

By Mr. Lesquereux the plant-bearing strata of Bellingham Bay and Vancouver's Island were regarded as of the same age; and from the resemblance of the species which they contain, to some of those found in the Miocene of Europe, he pronounces them to be of that age. (*op. cit.* Vol. XXVII. p. 362.)

In a subsequent number of the "American Journal of Science," (Vol. XXVIII. p. 85,) is published a letter from Prof. Oswald Heer, the eminent Swiss fossil botanist, containing remarks on these plants, of which drawings had been sent him by Mr. Lesquereux.

In these notes the extinct floras of Vancouver's Island

and Bellingham Bay are brought still nearer to that of the Miocene of Europe.

*Planera dubia* (Lesqx.) is regarded by Prof. Heer, as identical with *P. Unger*i, of Europe; *Cinnamomum crassipes* (Lesqx.) is said to be hardly distinguishable from *C. Rossmæsleri* (Heer); *Salix Islandica* (Lesqx.) is compared with *Salix macrophylla* (Heer); *Quercus Benzoin* (Lesqx.) is referred to *Oreodaphne Heeri* (Gaud.); *Quercus Gaudini* (Lesqx.) is said to be probably identical with a species from the Italian Tertiaries, and *Salisburia polymorpha* (Lesqx.) the representative of *S. adiantoides*, *Unger*i, etc.

By Prof. Heer, the coal strata of Vancouver's Island, and the opposite coast of Washington Territory — strata which contain the plants — are all regarded as unquestionably of Miocene age.

Now while this conclusion is apparently true as regards one of these localities, we have strong reasons for believing that it is not true of the other; in short, that the coal strata of Vancouver's Island, and those of the main land, are not of the same age; and that while the latter are probably, if not certainly of *Miocene* age, the former are *Cretaceous*.

In 1858, this conclusion was arrived at by the writer in an examination made at that time, of the collections forwarded by the Boundary Commission to Washington, in which the fossil plants of Nanaimo, Vancouver's Island, were found associated with a large, well-marked species of *Inoceramus*, and a *Pholadomya* (*P. subelongata*), previously described by Mr. Meek, with many other cretaceous fossils from another locality on Vancouver's Island. (Trans. Albany Institute, Vol. IV. p. 37).

The evidence now before us — if the specimens in the collection were obtained in the circumstances reported — show conclusively that all the plant-bearing strata about

Nanaimo, are of cretaceous age ; indeed, so far as at present known to us, all the fossils collected at Vancouver's Island are of that formation.

This evidence is not sufficient, however, to exclude all tertiary rocks from the island, as but a small part of it has been studied, and its geological structure is evidently somewhat complicated. From the great development of Miocene strata on the main land near by, we may even anticipate that similar rocks *will* be found in Vancouver, yet, so far as I am informed, they have not up to the present time been identified there.

In regard to the age of the plant-bearing strata of Bellingham Bay, there can be, I think, no reasonable doubt that, as suggested by Messrs. Lesquereux and Heer, and previously by the writer, (P. R. R. Rept. Vol. VI. Geol. p. 64,) they are Miocene.

We cannot, perhaps, assert positively that any of the species of fossil plants found at Bellingham Bay are identical with any from the Miocene strata of Europe, as a larger amount of material than we now have would be required for the settlement of that question, but the generic correspondence of the plants of Bellingham Bay and Oeningen, for example, is very striking, and several species from Bellingham Bay are so very like foreign ones, that I have been unwilling to regard them as distinct. For instance, besides the species mentioned by Mr. Lesquereux, *Taxodium occidentale* is closely allied to *T. dubium* of Europe, the only marked difference being, that in the American plant the leaflets are constantly rounded at both ends ; *Sabal Campbelli*, as represented in the collection of the Boundary Commission, is only to be distinguished from *S. major* by its flat unkeeled petiole ; *Smilax cyclophylla* is the representative of *S. orbicularis* ; *Quercus Banksiaefolia* is allied to *Q. Drymeja*, while *Glyptostrobus Europæus*, *Carpinus grandis*, and *Rhamnus Gaudini*



are either common to the two continents, or the American species are so like the European as to be undistinguishable without better specimens than have yet been procured. Guided only by the very imperfect view yet obtained of the rich flora of the Bellingham Bay deposits, we are compelled to regard it as corresponding to that of the Lower Miocene of Europe.

In the splendid collections of tertiary plants made by Dr. Hayden, on the Upper Missouri, are several species which are identical with some of those found at Bellingham Bay, and there is no question that the plant bearing strata of these two districts are essentially parallel.

At Point Dougherty, Orcas Island, a group of fossil plants was collected by the Commission, of which the age can scarcely be determined from the notes and specimens before us. The position of this island, as will be seen by reference to the map, is intermediate between Bellingham Bay and Nanaimo, and no reliable connection with the geology of either locality can be said to be as yet established, either by continuity of strata, or identity of fossils.

The plants, though numerous, are, with perhaps one exception, different from any yet found on the main land, or about Nanaimo. They include *Tæniopteris Gibbsii*, *Sphenopteris elongata*, a species of *Sabal* represented in the collection by specimens too imperfect for accurate determination, and several angiospermous leaves, among which are those of a *Cinnamomum*, perhaps identical with *C. Heerii* (Lesqx.). Nothing satisfactory can be deduced from a comparison of the plants collected in this locality, with any described from the cretaceous or tertiary rocks of other portions of America or of Europe, as the species are all new, and the genera not characteristic of either formation. Supposing the *Cinnamomum* to be identical with that of Nanaimo, I have conjectured that the plant-beds of Orcas Island were cretaceous.



This suspicion is also strengthened by the fact that Sucia Island, which is very near Point Doughty, has furnished a large number of well-marked cretaceous fossils, *Ammonites*, *Baculites*, etc. This evidence, however, is by no means conclusive, and the age of the strata of Orcas Island can only be accurately determined by future investigation.

The geology of all this region is evidently quite complicated, and most of the conclusions which have been arrived at in regard to it must be considered as in some degree provisional, and liable to future modification.

SPHENOPTERIS (ASPENIUM) ELONGATA Newb.

*Desc.* Frond bi- or tripinnate; pinnæ lanceolate, or linear, acute, lower ones broadly lanceolate, pinnatifid at base, margins deeply double-toothed, upper ones narrow, lance linear, wedge shaped at base, summit long-pointed, acute, margins coarsely toothed; nervation strongly marked, acute-angled, medial nerve of pinnæ vanishing toward the summit, secondary nerves diverging from this at a very small angle, radiating to the margins, dichotomously forked.

This beautiful fern is considerably unlike any hitherto described from the tertiary rocks, but exhibits a marked resemblance to some of those found in the older formations. It is very much like, in its general aspect, to *Sphenopteris Virletii*, Brongn. (Hist. Veget. Foss. I. p. 209, T. 58 F. 1-2.), some of the pinnæ having almost precisely the same form, but generally the lobes of the pinnatifid pinnæ in *S. Virletii* are narrower, deeper, and less oblique, and the marginal teeth less acute.

In the specimens contained in the collection, I have not been able to discover any traces of fructification; we are, therefore, not able to refer our plant with certainty to any of the living genera to which it might be supposed to belong. The venation and mode of division of the frond are, however, so similar to that of some species of *Asplen-*

*ium* — *Asplenium erosum*, etc., — that I shall be surprised if on the discovery of its fructification it is not found to belong to that genus.

*Formation and Locality.* Cretaceous? rocks. Point Doughty, Orcas Island.

TÆNIOPTERIS GIBBSII. Newb.

*Desc.* Frond simple, petiolate, oblong, elliptical in outline, rounder at base and summit; margins entire, midrib strong, straight, smooth; lateral nerves leaving the midrib nearly at a right angle, simple, fine, parallel, numerous.

The form and nervation of this leaf are so well given in the accompanying figures, that no lengthy description of it seems necessary. The fructification is not visible on the specimens contained in the collection, and its relation to living ferns must therefore remain for the present somewhat in doubt. It however falls clearly within the fossil genus *Tæniopteris*, and may be permitted to remain there until such time as its fructification shall be discovered, and its affinities with recent genera demonstrated. By its simple frond, strong midrib, and simple, parallel nerves, nearly horizontal, it resembles some of the species of *Olfersia* Presl; perhaps as much also the living *Oleandra neriifolia* and other species of the same genus.

Among described fossil ferns, there is none for which this need be mistaken. Three species only which have been referred to this genus have been described from rocks of Tertiary age, viz.: *T. Bertrandi*, Brongn. (Hist. Veget. Foss. I. p. 266, T. 82, F. 5,) from the Miocene of Lombardy, *T. dentata* Sternb. (Vers. 2, S. 141. Gopp. Syst. Fil. Foss. S. 355, T. 21, F. 7, 8,) and *T. Eocenica* Ung. (Gen. et Spec. p. 527,) from the Schists of Radoboj in Croatia, formerly regarded as Eocene, now as Lower Miocene. Another species is mentioned by Brongniart from the Italian Tertiaries, (Tab. des Gen. p. 21,) but it is not yet described. From the three species enumerated

above, ours is readily distinguishable. Of these, the first is linear lanceolate, acute, with acute-angled nervation, nerves usually forked; of the second, the form is also linear, the nervation acute-angled, nerves often forked, and the margin toothed; of the third, the outline is broadly linear, the nervation acute-angled, nerves forked at the base.

It gives me great pleasure to dedicate this interesting fern to my friend, Mr. George Gibbs, the Geologist of the Northwest Boundary Commission, by whom it was collected.

*Formation and locality.* Cretaceous? strata, Point Doughty, Orcas Island.

EQUISETUM ROBUSTUM Newb.

*Desc.* Stem robust, eight lines wide with about twenty-four strongly marked furrows; sheaths long; teeth long-pointed, acute, as many as the furrows; internodes a little longer than the diameter of the stem.

There is no living species of *Equisetum* which attains the size of the fossil before us; though it does not rival in this respect those found in the older mesozoic rocks. Between the living and older extinct species it seems to form a connecting link, a stepping-stone, by which the *Calamites* of the coal period, and the gigantic *Equiseta* of the Trias have come down to the humble dimensions of their present representatives.

There is no described Tertiary species with which it will be likely to be confounded. *E. procerum*, Heer, (Flor. Tert. Helvet. p. 158, Taf. CXLVI. fig. 1.) is even larger, but will at once be distinguished from it by its smoother stem and far more numerous and less acute teeth.

*Formation and locality.* Miocene Tertiary shale, Bel-  
lingham Bay, W. T.

ASPIDIUM KENNERLYI Newb.

*Desc.* Frond pinnate; pinnæ deeply pinnatifid; pin-



nules oblong, obtuse, somewhat curved upward, united at their bases, margins acutely denticulate, sometimes entire; nervation strongly marked, secondary nerves mostly once-forked, basal nerve of each pinnule on the lower side often twice-forked.

This elegant species seems to have grown in the greatest abundance during the period of the deposition of the coal of Vancouver's Island; the shales over the Newcastle coal being so closely packed with its fronds as to show them crossing each other in every direction under every lamina that is raised. From their very abundance and consequent interference, it is impossible to obtain the entire outline of a frond, or even of a pinna; the frond must, however, have been of considerable size, and the pinnæ eight or ten inches in length. These last are linear in outline, some of them somewhat curved, others quite straight, the difference being doubtless due to their different positions in the frond. The pinnules are usually arched upward, very broad at the base, rounded or obtusely pointed at the summit. Where well preserved, the margins of the larger ones are seen to be finely but distinctly denticulate. The nervation is quite strong, but the frond was evidently thick and firm, and though very prominent on the under side, on the upper the nerves are scarcely visible. The midrib is slightly sinuous, and vanishes toward the summit of the pinnule. The secondary nerves are generally once-forked, but the upper ones are simple, and the lower one on the lower side is often twice-forked, or rather two once-forked nerves spring from the same base.

Among fossil species this may be compared with *A. Filix antiqua* Al. Br. Heer, (Flor. Tab. Helvet. 1, S. 35, Taf. XI. fig. 1,) but though crenulated, the pinnules in that species are not denticulate, and they are not curved. The nerves are also less strong and more simple than in our plant.



*Formation and locality.* Cretaceous shales over Newcastle coal, Nanaimo, Vancouver's Island.

SABAL CAMPBELLI Newb.

*Desc.* Leaf very large, eight to ten feet in diameter, with fifty to seventy folds; petiole long, sixteen lines or more in width, flat above, without a central keel and unarmed; nerves numerous and fine, about fifty in each fold—six principal nerves on each side of the midrib, with three intermediate nerves between each pair, the middle one being strongest.

In its general character this palm bears a strong resemblance to *Sabal major*, Ung. Sp. (Chloris, Prot. S. 42, Taf. 14, fig. 2; Flor. Tert. Helvet. 1, S. 88, Taf. XXXV. XXXVI. figs. 1, 2,) the size of the leaf, the number of folds and the character of the nervation being nearly the same; but in our plant the petiole is apparently flat or slightly arched above, without the central keel of *S. major*. Unfortunately we have as yet obtained no specimen showing the under side of the leaf, and therefore want the important diagnostic character of the length of the point of the petiole.

From *Sabal Lamanonis* this species may be distinguished by its greater size, more numerous leaf-folds, finer and more crowded nervation, and by its flat unkeeled petiole.

Fan-palms are not now found on the Pacific coast above Cape St. Lucas, (Lat. 23° North,) though the average temperature would permit them to grow perhaps as far north as San Francisco, (Lat. 38°). In the valley of the Mississippi and on the Atlantic coast they extend northward to the parallel of 35°.

*Formation and locality.* Miocene Tertiary, Bellingham Bay, W. T.

SABAL Sp.

Fragments only of a fan-palm are contained in the collections made at Nanaimo; if, as now appears prob-

able, the beds containing it are Cretaceous, it will doubtless prove to be a new species.

The only tangible characters exhibited in the specimens yet obtained are in the nervation.

The nerves are very fine, nearly sixty in each fold, — six stronger ones on each side of the midrib, and between each two of these three finer ones, of which the middle is strongest.

TAXODIUM OCCIDENTALE Newb.

*Desc.* Branchlets terete, leaves numerous, crowded, generally opposite, sessile, or very short-petioled, one-nerved, flat, rounded at both ends.

This is the plant figured by Prof. Dana, (Geol. Explor. Exped. Atlas, Pl. 21, fig. 3,) and considered by Prof. Heer — judging from that figure — as identical with *T. dubium*, a species very common in the Tertiary of Europe. Future investigations may confirm this identification, but the specimens before us exhibit so well-marked and constant differences from those of the European *T. dubium*, that we must conclude them distinct, at least till such time as common characters may be discovered which shall unite them.

Judging from the leaves alone, for we have not yet met with the fruit, if there is any propriety in separating *T. dubium* from the living deciduous cypress *T. distichum*, our plant should be regarded as a new species, as it is more unlike either than they are unlike each other.

In *T. dubium* the leaves are fewer, more obliquely set on the deciduous branchlets, are short-petioled, and acute at both ends. Even in *var. c.* “*foliis apice obtusiusculis*,” (Heer, *op. cit.* p. 50, Taf. XVII. fig. 19,) there is no very marked departure from the normal form, while in the numerous specimens collected on the Pacific coast by Mr. Gibbs and Prof. Dana — all of which are before me — the leaves are mostly closely set, given off from the branchlet

at a large angle, —  $45^{\circ}$  to  $90^{\circ}$ , — are opposite, sessile, or very short-petioled, and are rounded at both ends, sometimes even emarginate at the summit.

The specimens brought from the Yellow Stone, by Dr. Hayden, though generally much larger and stronger, exhibit the same general character.

In both collections are slabs literally covered with branchlets which seem to have fallen simultaneously, precisely as the terminal branchlets of our deciduous cypress are thrown down together by an autumnal frost.

*Formation and locality.* Tertiary rocks, Birch Bay, above Bellingham Bay, Washington Territory.

*TAXODIUM CUNEATUM* Newb.

*Desc.* Leaves numerous, short, broad, spatulate in form, rounder or sub-acute at summit, wedge-shaped below, narrowed into a very short petiole, or sessile upon the branchlets.

The specimens of this plant contained in the collection, though numerous, are too imperfect for satisfactory description. If found in strata of the same age, it might be considered but a variety of *T. occidentale* or *T. dubium*; but if we can trust the accuracy of the very intelligent gentleman by whom it was collected, it is clearly of Cretaceous age, and therefore, in all probability, quite distinct from any described species.

The spatulate or cuneate form of the leaves, if this should be found to be a constant character, would serve to distinguish it at a glance from its Tertiary representatives.

*Formation and locality.* Green cretaceous sandstone, Nanaimo, Vancouver's Island.

*GLYPTOSTROBUS EUROPEUS.*

*Desc.* I have referred the numerous specimens of *Glyptostrobus* in the collection with much doubt to *G. Europæus*, but I shall not be surprised, if, when we have a better representation of the leaves and fruit of this plant, it shall be considered distinct. Unfortunately, we have not



yet procured the cones, or any cone scales from the Western coast, and we therefore want data without which it is impossible to say with certainty whether this is identical with the European species or not.

The foliage exhibits an almost constant variation from that of *G. Europæus*, as that species is described and figured, and if it shall be decided that it is not specifically distinct, it is certain that the specimens from Western America represent a peculiar variety.

These specimens exhibit two forms of foliage. On some branches the leaves are half an inch long, and arranged in two rows; these specimens are scarcely distinguishable from those described by Heer as "linearibus patentibus distichis," and figured in Foss. Flor. Helvet. Taf. XVIII. fig. 5. Other branches, and by far the most numerous, are clothed with much shorter awl-shaped leaves, often closely appressed; but they are always longer and sharper than the appressed leaves of the European specimens. The leaves of both forms may usually be seen to be keeled, but they are not always so.

The beautiful specimens of *Glyptostrobus* obtained by Dr. F. V. Hayden from the Miocene Tertiaries of Nebraska, which include the cones and leaves in great variety, and from various localities, are most faithful copies of the representatives of *G. Europæus* figured by Prof. Heer, including the two forms formerly known as *G. Unger*i and *G. Europæus*. On the West coast, however, nothing has yet been found which corresponds to the typical *G. Europæus* with its appressed foliage rounded and obtuse, its cone scales regularly fluted and scalloped, etc.

The extreme western plant comes nearer *G. Unger*i, and has a very different aspect; and yet if it is true, as Heer supposes, that *G. Europæus* and *G. Unger*i are only varieties of the same species, the specimens from Washington Territory and Nebraska may very well belong to the same plant, and that be undistinguishable from *G. Europæus*.



*Formation and locality.* Miocene strata, Birch Bay and Bellingham Bay, W. T.

CINNAMOMUM HEERI Lesqx.

Guided only by the brief description given by Mr. Lesquereux, I cannot be positive that the species of *Cinnamomum* before us is identical with that procured by Dr. Evans from Vancouver's Island. In Mr. Lesquereux's specimens the summit of the leaf was wanting, but he conjectures that the lateral nerves extended to the point. Among my specimens are several in which the upper extremity of the leaf is preserved.

From these it appears that the lateral nerves terminate in the margin before reaching the point. This would separate it from *C. Buchi*, and would bring it nearer to *C. Scheuchzeri*, or *C. lanceolatum*. My specimens, however, indicate a larger and thicker leaf than that of either of these species.

It would be a matter of no little interest to determine the relations of the specimens of *Cinnamomum* contained in the Boundary Collection with those brought from Vancouver's Island and Bellingham Bay by Dr. Evans, as that would probably permit us to decide whether the plant beds of Orcas Island should be grouped with those of the mainland, or with those of Nanaimo.

*Formation and locality.* Cretaceous? strata, Orcas Island.

CARPINUS GRANDIS? Ung.

*Desc.* Leaves elliptical, ovate elliptical, or ovate lanceolate finely double serrate, secondary nerves twelve to twenty, slender, parallel.

Among the fossil plants brought by the United States Exploring Expedition from the coast above Bellingham Bay, there are numerous impressions of a *Carpinus* which I have been unable to distinguish from *C. grandis* of Europe. They are, however, for the most part, imper-

fectly preserved, and can hardly be regarded as sufficient to determine, beyond a question, the identity of strata found at localities so remote from each other.

This is the plant figured by Prof. Dana in the Geology of the United States Exploring Expedition. (Atlas, Pl. 21, fig. 15.)

*Formation and locality.* Miocene strata, Birch Bay, W. T.

RHAMNUS GAUDINI ? Heer.

A single specimen of what may be this species is contained in the collection of the United States Exploring Expedition, made by Prof. Dana, and figured in the Atlas accompanying his geological report (Pl. 21, figs. 11 and 12).

It is not sufficiently well preserved, however, to make its accurate determination possible.

*Formation and locality.* Miocene tertiary strata, Birch Bay, W. T.

SMILAX CYCLOPHYLLA Newb.

*Desc.* Leaves circular or round, ovate, cordate, or slightly peltate at base, five-nerved, central and interior pair of lateral nerves strongly marked, basilar pair delicate, and scarcely reaching the middle of the leaf; secondary nervation forming a polygonal net-work more or less rectangular.

Unfortunately, the only specimen of this plant which I have is that collected by Prof. Dana, and figured in his Geology of the United States Exploring Expedition, Atlas, Pl. 21, fig. 10, and is imperfect, the upper part of the leaf being wanting. So far as its outline is indicated by the part which remains, it would seem to have been nearly orbicular. If such was the case, it resembled in general the aspect leaves of *S. orbicularis*, Heer, (Tert. Flor. Helvet. 3, S. 167, Taf. CXLVII. figs. 18, 19,) and perhaps as much those of the living *S. rotundifolia*.

From *S. orbicularis* it differs, however, in the shortness

of the exterior pair of lateral nerves, and in the polygonal reticulation of the secondary nervation.

*Formation and locality.* Tertiary strata, Birch Bay, W. T.

QUERCUS CORIACEA Newb.

*Desc.* Leaves lanceolate, long-pointed, acute, wedge-shaped at base, decurrent on the petiole; margins entire, or rarely bearing a few acute teeth toward the summit; nervation strongly marked; midrib strong; lateral nerves numerous, sub-parallel, branching and inosculating at the summit.

This is one of the willow oaks represented among recent species by *Q. imbricaria*, etc.

The figures given illustrate the variations of form exhibited in the collection. From these it will be seen that with the general character of *Q. chlorophylla* Ung., and *Q. elaena* Ung., it is distinct from both, the first being rounded above and with finer nerves, the second larger and narrower, with a nervation finer and closer, and the summits of the lateral nerves more distinctly and regularly united.

*Formation and locality.* Miocene Tertiary strata, Bel-  
lingham Bay, W. T.

QUERCUS FLEXUOSA Newb.

*Desc.* Leaves four to six inches long, lanceolate, often more or less curved, pointed, acute, narrowed at the base to the petiole; margins somewhat irregularly sinuate dentate; nervation strongly marked, lateral nerves forked and anastomosing at the summit.

This is evidently one of the chestnut oaks, but has not the regularity of nervation which characterizes most of that group, of which *Q. castanea* may be taken as a type.

Among fossil species there are many to which it bears considerable resemblance, such as *Q. Gaudini* Lesqx., *Q. Gmelini* Ung., *Q. urophylla* Ung., etc., but from these and all others described it seems to be sufficiently distinct.



In *Q. Gaudini*, the secondary nerves are curved and run along the margins. In the other species mentioned they are less numerous, and more curved, and the marginal teeth are coarser.

*Formation and locality.* Miocene Tertiary strata, Bellingham Bay, W. T.

*QUERCUS BANKSIÆFOLIA* Newb.

*Desc.* Leaves very long, linear, lanceolate, long-pointed and acute at either end; margins set with numerous nearly uniform, acute, appressed teeth turned toward the superior extremity; midrib strong, running the entire length of the leaf; lateral veins numerous, simple, strongly marked, parallel, arched upward, terminating in the teeth of the margin; reticulated nervation buried in the thick parenchyma of the leaf, and generally invisible in the fossil state.

This beautiful leaf resembles, in the style and strength of its nervation, those of the living chestnut oak, but is more slender than any other species, living or fossil, which has come under my observation.

Among described fossil species, *Q. drymeja* Ung., (*Chloris protogæa* S. 113, Taf. 32, figs. 1-4,) *Q. lonchitis* Ung., (*Flor. v. Sotzka*, Taf. 9, figs. 3-8,) and *Q. Saffordi* Lesqx., (*Geol. Survey of Arkansas*, p. 319, Tab. VI. fig. 3,) seem to approach it most closely, the former two, indeed, being very nearly allied to it; but in these species the leaves are broader and the lateral nerves are more remote. In *Q. Saffordi* the leaf is, perhaps, equally slender, but the teeth are coarser, and less depressed, and the nervation much less strong and regular, resembling in this respect that of the willow oaks (*Q. phellos*, etc.). The living species with which our plant may be compared are *Q. Xalapensis*, and, judging from Prof. Heer's description of it, *Q. Sartorii* Liebman. Both of these are from Mexico.



*Formation and locality.* Miocene Tertiary strata, Bellingham Bay, W. T.

*QUERCUS ELLIPTICA* Newb.

*Desc.* Leaves elliptical or ovate, rounded or somewhat wedge-shaped at base, pointed above; margins entire. Surface smooth, consistence thick and leathery; nervation strong; lateral nerves numerous, diverging at a large angle, slightly arched upward, often sinuous, forked and anastomosing above.

In its nervation this species resembles several of the laurel-leaved oaks already described from the Tertiary rocks of Europe, such as *Q. nereifolia*, *Q. Heerii*, *Q. elatena*, etc., but is distinguishable from all these and other otherwise similar species by its broad elliptical or ovate outline. The margins in the specimens before us are apparently entire, but they are probably sometimes toothed, as in most allied species.

*Formation and locality.* Miocene strata, Bellingham Bay, W. T.

*POPULUS RHOMBOIDEA* Lesqx.

In the collection of the Boundary Commission are numerous specimens which I have referred with some doubt to species of *Populus* described by Mr. Lesquereux, (Amer. Jour. Science, Vol. XXVII. p. 360). My specimens are, however, too imperfect to permit me to decide with a certainty the question of their identity. Associated as they are with *Inoceramus*, there can be no reasonable doubt of their Cretaceous age.

Among the fossil leaves brought from Orcas Island, there are some which bear considerable resemblance to these, but they are too imperfect to render the comparison satisfactory.

*Formation and locality.* Cretaceous strata, Nanaimo, Vancouver's Island.

*POPULUS FLABELLUM* Newb.

*Desc.* Leaves flabellate, orbicular or reniform, obtuse, wedge-shaped at base, slightly decurrent onto the petiole. Margins entire or waved; principal nerves three, two lateral ones reaching nearly to the summit; secondary nerves fine, flexuous, forked.

There is no living species of *Populus* of which the normal form of the leaves approaches very closely to that of those under consideration, though one, three-nerved like these, may be occasionally found among the round-leaved poplars. Among the Tertiary plants collected by Dr. Hayden on the Yellow Stone, is a species yet unpublished very much like this, both in the form and nervation of the leaves, and among the Cretaceous plants collected by the same geologist in Nebraska, is another nearly equally like; but in both these the upper margins of the leaves are more or less crenulated.

*Formation and locality.* Miocene strata, Bellingham Bay. W. T.

*FICUS ? CUNEATUS* Newb.

*Desc.* Leaves obovate or elliptical, shortly acuminate at summit, wedge-shaped at base, decurrent onto the petiole; nervation distinct, flexuous, reticulated; midrib strong; lateral nerves eight or nine pairs gently arched upward, the lower ones curved at the extremities, anastomosing near the margin, the upper ones forked above the branches, meeting and forming a coarse net-work.

The specimens of this plant are too few and too obscurely preserved to permit my accurate determination; for the present it may be left in the genus *Ficus*, to some species of which it certainly bears a close resemblance, both in outline and nervation.

*Formation and locality.* Cretaceous strata, Orcas Island.

ART. XI. — On *Arachnactis brachiolata*, a Species of Floating *Actinia* found at Nahant, Massachusetts. By A. AGASSIZ.

[Communicated Oct. 1, 1862.]

LIKE the Norwegian species mentioned by Sars,\* our *Arachnactis* is found in the autumn; the first specimens occurred about the beginning of September, and had only four tentacles. (Fig. 1.) They are exceedingly abundant at night; large numbers were caught every evening with the dip net.† Their general appearance is so like a *Brachiolaria*, that, at first not recognizing it as a Polyp, I supposed it to be the larva of one of our star-fishes. The manner in which they move is precisely similar to that of the larva of one of our common star-fishes, the *Asteracanthion berylinus* Ag. They always swim with the disk turned down, the abactinal region pointing up, and the longitudinal axis of the body inclined. Their movements are very slow, as up to the time when they have sixteen tentacles, and have reached a length of about one eighth of an inch, they propel themselves almost entirely by means of the numerous ciliæ which are scattered on the surface of the tentacles.

The tentacles themselves are not capable of extensive contractions; they can simply be slightly shortened, and curved over the opening of the mouth, and are never drawn into the disk as in *Actinia*. The column itself contracts only little, even when irritated by touch. The body is perfectly transparent, so that the partitions can readily be seen through the outer wall. They extend from the

Fig. 1.



Young *Arachnactis*, narrow side facing pair of tentacles.

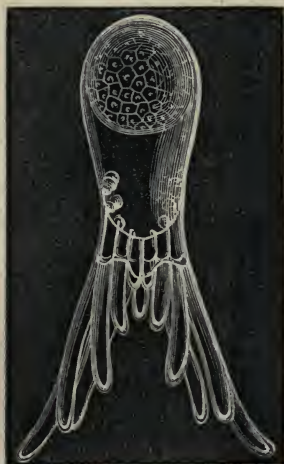
\* Sars, M. Fauna littoralis Norvegiæ, Erste Lieferung. Christiana, 1846.

† Agassiz, A. Proc. Bost. Soc. Nat. Hist. Vol. ix. p. 159.



central wall to the periphery, as transparent lamellæ reaching, as in *Edwardsia*,\* but a small distance from the

Fig. 2.



*Arachnactis brachiolata*, narrow side facing pair of tentacles.

Fig. 3.



Disk seen from above.

actinal region towards the abactinal side. Fig. (2.) The partitions corresponding to the first-formed tentacles remain always larger and more prominent than the others.

When seen from different sides the aspect of this actinia is very different. It exhibits to a remarkable degree bilateral symmetry. When seen from above we can see at once, even in young specimens in which there are not more than four tentacles, that the slit of the mouth is not placed in the centre of the disk, but nearer one edge, (fig. 3.) and that the tenta-

cles are not arranged in circles round the mouth, the largest nearest the mouth slit. On the contrary, the tentacles are arranged in two simple, independent rows, one row surrounding the mouth slit, and the other arranged precisely in the same way on the edge of the disk. The mode of development of the tentacles is such that

the youngest, the smallest, last-formed tentacles, either round the mouth or round the disk, are always placed at one end of the mouth slit. It is there that additional tentacles are formed, and not in the intermediate spaces between the first tentacles. Unlike other Polyps, the tentacles of the first cycle are not developed at the same time, but

\* Quatrefages, A. de., Mémoires sur les Edwardsies, (*Edwardsia*), nouveau genre de la famille des Actinies. Ann. Sc. Nat. 1842, Vol. xviii. p. 65.



at one extremity of the longitudinal axis of the mouth we find the oldest tentacles, while at the other, tentacles are constantly added which belong to one and the same cycle, although not all formed at the same time. Besides these tentacles which are all in pairs, an odd tentacle is developed opposite the extremity of the mouth nearest the edge of the disk. (Fig. 3.)

The disk of specimens having as many as sixteen tentacles, (fig. 2,) is very elliptical, the whole body being strongly compressed laterally in the same direction as the slit of the mouth. (Fig. 3.) So that, when seen from the narrow side facing the odd tentacle or the youngest pair of tentacles, the appearance of the animal is quite different. In the first case the tentacles are arranged symmetrically on both sides of the small odd tentacle, (fig 4,) an uneven number of tentacles being seen; while in the second case there is an even number of tentacles seen arranged on both sides of the prolongation of the longitudinal axis of the mouth, as in fig. 2. When seen from the broad side the aspect is still different, the tentacles decreasing regularly in size, after the second pair, from the extremity where the odd tentacle is placed towards the part of the disk where the new tentacles are added. (Fig. 5.) This figure has only three pairs of tentacles, but the proportions of the different tentacles always remain, in the specimens which I have seen, nearly like this, as can readily be seen from figure 2, which has six pairs of tentacles. When seen from the narrow side, the large tentacles are placed symmetrically on both sides of the disk.

Fig. 4.



Tentacles of fig. 2 from the narrow side facing odd tentacle.

Fig. 5.



Figure 3 from the broad side.

The same bilateral symmetry can be traced in the tentacles which surround the mouth. The largest are placed nearest the odd tentacle, and they decrease in size toward the opposite extremity of the mouth.

The body is of a pale ochre color, perfectly transparent; the edge of the tentacles and of the partitions appears somewhat darker, owing to the thickness of the walls. The extremity of the column is rounded, the wall is slightly thickened there, and there is no trace of any opening at the base of the columns or at the tip of the tentacles. The digitate appendages which hang in the cavity of the body are simply thin folds of the prolongation of the partitions twisted like a corkscrew as they become longer. When seen from the narrow side, (fig. 2,) these appendages are arranged symmetrically on both sides of the longitudinal axis of the body; but when seen from the broad side, the curves are always in one direction, the convexities turned away from the side where the odd tentacle is placed.

The tentacles of the mouth slit are short, conical, almost always carried vertically upward, but when the sides of the digestive cavity are in great activity and project beyond the surface of the disk, they are often extended perfectly flat upon the actinal area. In young specimens, (fig. 1,) the whole cavity of the column is filled with a spherical mass composed of large polygonal yolk-cells. This sphere revolves slowly about in the interior, and as the actinia becomes older it is reduced in size, and the space is filled by the digitate appendages. When the actinia is in motion, the young tentacles are on the side of the body which is nearest the surface, the long, heavier tentacles being below.

The youngest specimens of *Arachnactis* found resemble, in a striking manner, the more advanced figures given by Haime,\* of the young *Cerianthus*. The mode of develop-

\* Haime, Jules, Mémoire sur le Cériante (*Cerianthus membranaceus*). Ann. Sc. Nat. 4<sup>me</sup> Sér. I. p. 341.

ment of the tentacles appears to be the same. There are at first four tentacles of which two are much larger than the others, and between the largest ones is formed the odd tentacle, which Haime considered as a tentacle of the second cycle, but which I have shown to remain always odd in *Arachnactis*. When we compare the figures given by Busch\* of *Diantheus nobilis*, which is undoubtedly, as Leuckart† thinks the young of *Cerianthus membranaceus*, or of *Saccanthus*, we shall find still greater resemblances to the figures I have given of our *Arachnactis*. As the stages observed by Busch are more advanced than those of Haime, there can be no doubt after examining his figures that the mode of development of the tentacles of *Cerianthus* is identical with that of *Arachnactis*. We have then in the family of Cerianthidæ as established by Milne Edwards,‡ (he does not include in it *Arachnactis*,) a mode of development of tentacles which is entirely different from what we find in the other actiniæ. This mode of development is found in genera which are connected by structural differences, which would seem to prove that here we have a group of greater value than a simple family, which must rank as a suborder in the order of *Actinaria*, and include in it two families of which *Cerianthus* and *Arachnactis* are the representatives.

In these actiniæ the partitions of the same cycle are of different lengths, two of them always retaining their greater predominance. They have two sets of rows of tentacles, one round the mouth, the other round the edge of the disk, plainly showing that *Cerianthus* and *Arachnactis* form a

\* BUSCH, W. Beobachtungen über Anatomie und Entwicklung einiger wirbelloser Seethiere. Berlin, 1851.

† LEUCKART, R. Bericht über die Leistungen in der Naturgeschichte der niederen Thiere während der Jahre 1848-1853. Archiv für Naturgeschichte, 1852, ii. p. 461.

‡ EDWARDS, H. MILNE. Histoire Naturelle des Corallaires, Tome i. Paris, 1857.



group of greater value than a family, a suborder in the order of *Actinaria*.

In what way the additional tentacles of the edge of the disk of *Cerianthus* are developed, I am unable to say, nor can I state whether the tentacles which are first formed always retain their greater size, as is the case in *Arachnactis*.

The most advanced specimen of *Arachnactis* which I have figured (fig. 2), has evidently not reached its full size, as the sphere of yolk cells has not entirely disappeared, and no sexual organs have been observed.

#### EXPLANATION OF THE FIGURES.

The figures are all placed with the tentacles down, as that is the natural attitude of these animals while swimming.

Fig. 1. A young *Arachnactis* having four tentacles seen from the narrow side, facing the pair of youngest tentacles. The two small tentacles seen in the figure, are the large pair of tentacles of the opposite extremity of the mouth slit.

Fig. 2. An *Arachnactis brachiolata* with thirteen marginal tentacles also seen from the narrow side, facing the pair of last formed tentacles, the digitate appendages are seen symmetrically arranged on both sides of the column; the sphere of yolk cells is much reduced in proportion to the size of the cavity.

Fig. 3. The disk of a young *Arachnactis* seen from above; there are three pairs of marginal tentacles, the odd tentacle is developed, and placed on the right of the figure, the fourth pair of tentacles is still united in one protuberance. The tentacles round the mouth slit are as yet simple thickening of the walls round it projecting straight up as seen in figures 1 and 5.

Fig. 4. The same as figure 2, seen from the narrow side



facing the odd tentacle, the large pair of tentacles round the mouth is quite prominent in this figure.

Fig. 5. Figure 3 seen from the broad side to show the mode of arrangement of the tentacles of the two sets of tentacles, the odd tentacle is on the left of the figure, the last formed pair on the right.

ART. XII.—*Prodromus of the History, Structure, and Physiology of the order Lucernariæ.* BY Prof. HENRY JAMES-CLARK, of Harvard University, Cambridge, Mass.

[Communicated January 7th, 1863.]

IN the month of September, 1862, I discovered upon our coast a Lucernarian, *Halimocyathus platypus*, H. J. C., which differed in such a remarkable degree from the most commonly known form, *Haliclystus auricula*, H. J. C., that I deemed it to belong to a different family from the latter; but in order that there might be no lack of correlative confirmation, I obtained, by the help of friends, sufficient materials to warrant me in making a complete revision of the whole order. This I now present in the form of a prodromus, rather than an elaborate treatise, simply because I desire at the earliest possible time to incite naturalists to a closer investigation of the habits, structure, and relations of this remarkable order, and moreover that by their labors I may profit whilst working out the memoir which I have had in preparation for many months.

LUCERNARIÆ.\* H. James-Clark.

An order of pedicellated Acalephæ.

The disc more or less octagonal or circular, and varying

\* See my paper entitled "Lucernaria the Cœnotype of Acalephæ." Proceed-

from umbellæform to infundibuliform or urnæform; the aboral side at the centre extended into a monocamerous or tetracamerous pedicel, whose base constitutes the principal means of attachment and progression; the middle of the oral side extended into a cylindrical quadrate mouth, with plicate lips; the oral and aboral sides of the disc consist each of two walls, between which is included a gelatiniform layer of varying thickness, which in the aboral side, although compressible and resilient, is uncontractile, but in the oral side is contractile, and constitutes the *musculo-gelatiniform* layer, which is also continuous into the tentacles and marginal anchors, between their outer and inner walls, whilst the aboral gelatiniform layer is continuous into the pedicel between its outer and inner walls; the cavity of the disc divided into four quadrant cameræ by the junction of the oral and aboral sides along four equidistant lines, thus forming so many partitions which extend from the base of the four flanks of the quadrate mouth nearly to the intertentacular margin; the discal cameræ either simple (*Eleutherocarpidæ*), or each subdivided into two superposed spaces (*Cleistocarpidæ*) by a horizontal membrane or diaphragm, which extends from the base of each of the four angles of the mouth to the distal ends of the approximate halves of neighboring genitals; exteriorly the oral side of the disc is divided into four depressions, corresponding to the region about the four partitions, and four elevations alternating with the latter, and constituting the four buttress-like basilar extensions from the angles of the mouth: in the area of the four depressions are situated the four principal muscular layers; in the region of the four elevations are the four

ings Boston Soc. Nat. Hist., May 1862, p. 47, in which I have attempted to prove that the Lucernarians are a distinct order of Acalephæ. I take occasion here to correct a provoking error in the paper referred to: on the 53d page, line 8, *less* should be *more*.

weaker muscular layers; both of the above layers are immediately subjacent to the outer wall, and terminate, at the edge of the disc, in a marginal muscular band which, with varying degrees of breadth and thickness forms a complete ring passing outside the bases of the tentacles and anchors, and constitutes the terminus of the oral side of the disc: the tentacles are disposed in eight groups on the oral face just within the margin of the disc, and at eight points which alternate with the four partitions and the four corners of the mouth; in each group those of the outermost row are the oldest; they are hollow,\* open into the general cavity of the body, cylindrical, slightly tapering, and terminate in a globular or spheroidal expansion which serves a tactile purpose or as an organ of prehension:† the intertentacular margin is either simple or at eight points, exactly opposite the four partitions and the four corners of the mouth, bears in youth a single tentacle, which with increasing age, by the development of adhesive vesicles in the outer wall, below the globose tip, becomes more or less modified in shape and proportions, according to the species, varying from pistilliform to broadly oval, fabæform or trumpet-shape, and serves as an organ of adherence and progression, of the same nature as the base of

\* In Milne Edwards' description of the plates of Zoöphytes belonging to the third edition of Cuvier, Pl. 63, fig. 1, and in Edwards and Haimés' Hist. Nat. Coralliers, Vol. 3, p. 456, the tentacles are represented to have closed cavities, with an ampulla at the base, like the ambulacral tubes of Echinoderms; this I am convinced is a mistake, the ampullæ being merely the more or less thickened, lobulate projections between the bases of the tentacles, as I have fully proved for myself by examination not only of our common Lucernarian, *Haliclystus auricula*, but also of the same species that Edwards had, viz.: *Calvadosia campanulata* (*Lucernaria campanulata* Lamx.)

† As I shall have occasion to speak of the radial and the transverse development of the groups of tentacles, I give here a brief description of their taxis and of the mode of its development. In a young *Haliclystus auricula*, not quite  $\frac{1}{16}$  of an inch in diameter, there are four tentacles in each tuft, — No. 1, the oldest and outermost; No. 2 the next oldest; No. 2a the next youngest; and No. 3 the youngest. In another bunch on the same individual there

1
2   2a
3



the pedicel: the motive power of the tentacles and the marginal anchors consists of a longitudinally fibrillated muscular layer situated just beneath their outer wall, and is directly continuous with the muscular layer in the oral side of the disc: in the pedicel the muscular system is either imbedded in the gelatiniform layer, or forms longitudinal ridges upon the inner face of it; in the former case it either consists of four longitudinal cords extending from the base of the pedicel, throughout its length, to the inner ends of the partitions, or it forms a continuous sheath subdividing the gelatiniform layer into two portions; in the latter case the four ridges\* are purely muscular and like the imbedded cords extend from the base of the pedi-

are six tentacles, arranged as in the second diagram. No. 1 the oldest; and Nos. 2, 2a, 3, 4, 4a successively younger. Bunches on each side of any one partition develop in opposite spirals, as the third diagram illustrates; *a b* is the partition. In a specimen a little older than this,

about  $\frac{3}{8}$  of an inch in diameter, the tentacles are arranged as in the fourth diagram. No. 1, the oldest, and Nos. 2, 2a, 3, 4, 4a, 5, 6, 6a, successively younger, and as in the last case, in opposite spirals on each side of a partition. In this, the last, instance, it is clear that the radial

development, Nos. 1, 3, 5, is the same in rate as the transverse Nos. 6a, 2a, 1, 2, 6, so that the tuft is about as broad one way as the other. In a tuft of seventeen tentacles of *Halimocyathus platypus*, the succession is as in the fifth diagram; No. 1 the oldest, and Nos. 2, 2a, 3, 4, 4a, 5, 6, 6a, 7, 8, 8a, 9, 9a, 10, 11, 12, successively, the younger ones.

By this it is evident at a glance that

the radial development, Nos. 1, 3, 5, 7, 10, 11, 12, is far in excess over the transverse Nos. 8, 2, 1, 2a, 8a. In *Carduella* the transverse development is far more rapid than the radial. Allman represents a young one with five or six tentacles in a group, and all in a transverse row. Sars figures a still older one having two transverse rows in each group, and four or five in each row.

\* In this case the muscular pilasters of *Lucernaria quadricornis* are not to be confounded with the pilasters in the pedicel of *Calvadosia*, as in the latter they are totally devoid of muscle. — See the diagnosis and description of the latter farther along.

1
2 2a
3
4 4a

1
2a 2
3
4a 4

1
2 2a
3
4 4a

*a*  
*b*

1
2 2a
3 3a
4 4a
5
6 6a
7
8 8a
9 9a
10
11
12

1
2a 2
3a 3
4a 4
5

1
2 2a
3 3a
4 4a
5

*a*  
*b*



cel to the partitions, where they become continuous with the muscular layer of the oral side of the disc: organs of generation diœcious; they occupy the same position in the male as in the female, and have the same general structure in both, which consists of saccules attached to the inner wall of the oral side of the disc, and arranged more or less closely together, so as to form variously shaped groups or bands; each individual has eight of these bands, every two of which constitute the halves of a single genital, and are either separate from each other, or united across the axial end of a partition, so as to form a U-shaped organ, the two limbs of which extend in a greater or less degree toward the groups of tentacles or the intertentacular margins; the convex edge of the U is bordered by one or more rows of ligulate, digitiform, or filamentary bodies, which extend from the inner or proximal end of the septal region, either one third, one half, or even along the whole length of the genitals; of each ligulate filament, at least in *Haliclystus auricula*, the side which faces toward the band which it borders, is covered, like the whole of the general cavity, with vibratile cilia, and on the opposite side there are no cilia, but a layer of closely set adhesive vesicles identical in structure with those on the anchors and in the base of the pedicle; lasso-cells are also numerous on the ciliated side, and all around the end of the filament.

## FAMILIES OF THE ORDER LUCERNARIÆ. H. J. C.

## 1st. — Family. CLEISTOCARPIDÆ. H. James-Clark.

The neighboring halves of adjoining genitals approximate each other and unite at their distal ends opposite the corners of the quadrate mouth and extend to or toward the four intertentacular margins which alternate with the partitions; the approximate genital halves, from their axial

to the distal end, united by a transverse horizontal membrane, which divides each of the four quadrant cameræ of the disc into two superposed spaces, the oral one of which forms a *cul de sac*, or claustrum\* opening at the axial end, and includes the genitalia. *Halimocyathus*, *Craterolophus*, *Manania*, *Carduella*, *Depastrum*.

2d. — Family. ELEUTHEROCARPIDÆ. H. James-Clark.

Each genital half, projecting freely† into the discal cameræ, extends in a direct line from the inner or axial end of a partition to or toward the end of an arm; the four quadrant cameræ of the disc simple. *Lucernaria*, *Calvadosia*, *Haliclystus*.

Family. CLEISTOCARPIDÆ. H. J. C.

HALIMOCYATHUS.‡ H. James-Clark.

Disc infundibuliform, octohedral; arms produced: pedicel tetracamerous: tentacles in groups at the end of the arms, outer row pistilliform like the marginal anchors, radial development of the group greater than the transverse: marginal anchors pistilliform: genital halves transversely folded bands, united at their proximal ends across the end of the intervening partition, their distal ends reach nearly to the marginal anchors; the digitate bodies do not extend across the proximal end of the partitions: muscles of the pedicel four filaments alternate with the four cameræ: principal muscles of the disc eight ligulate bands, arising from the proximate ends of the partitions, extend

\* Hence the name of the family Κλείω, to confine; καρπός fruit.

† Ἐλεύθερος, free.

‡ Ἀλμος, marine; κύαθος, cup.

to the end of each arm : marginal muscle broad and thin, forming a sort of velum which projects beyond the margin of the aboral side ; at the end of the arms it merges into the ligulate muscles of the oral side of the disc : gelatiniform layer of the aboral side, and the pedicel, conspicuous.

HALIMOCYATHUS PLATYPUS. H. James-Clark.

The disc or bell deeply infundibuliform ; the arms nearly twice as long as broad, and one third as long as the height of the disc from the pedicel to the margin ; the marginal sinuses no broader than the arms : the pedicel short, half as high as the disc ; at the narrowest part, where it joins the body, its diameter is nearly one half its length, and from there it gradually broadens into a very large base, which has a width equal to the length of the pedicel ; round, or very slightly furrowed at four points opposite the muscles ; in the middle of the base a small round opening leading to a cylindrical cavity, lined by the outer wall, which projects into the gelatiniform axis considerably beyond the horizon at which the pedicel cameræ terminate ; the four cameræ very large, closely approximated to each other and to the axis, so that they have very narrow strips of gelatiniform substance between each other, or between them and the axis ; transversely quadrant ; altogether they occupy the axial two thirds of the pedicel, and as the latter broadens toward its base the cameræ broaden also, so as to retain their proportionate size throughout ; they open widely into the cavity of the bell, neither at the base nor at any point have they any intercommunication : tentacles thick, about as long as the greatest breadth of the arms, seventeen to twenty in each tuft, the radial diameter of the tuft much greater than the transverse ; in a bunch containing seventeen there are seven tentacles in the middle radial row, four in each row on either side of the latter, and one in each outermost row, the last close to the distal side of the

tuft; the three in the distal transverse row pistilliform, *i. e.*, the distal side of the three tentacles is considerably thickened by the development of a layer of adhesive vesicles, but not to such an extent as to disguise their tentacular nature, united at their bases for one quarter of their length, as if a triple organ; the length of the largest tentacles is to their thickness as eight is to one, the length of the pistilliform ones is to their thickness as five is to one; the terminal knob globose, slightly depressed at the end, as broad as the base of the tentacle: marginal anchors reverted, very small, one third as long as the pistilliform tentacles, but proportionately thicker, their length being a little less than three times their radial diameter, *i. e.*, from the distal to the proximal side, and a little less than twice their lateral diameter; the layer of adhesive vesicles nearly of uniform thickness from the knob to the base where it rather abruptly thins out; in the pistilliform tentacles this layer is thickest midway between the base and the knob, and gradually thins out each way; in both anchor and pistilliform tentacles it occupies the distal two thirds of the circumference; the knob of the anchor is proportionately much smaller than that of the tentacles: genitals transversely fifteen to seventeen times folded, ligulate bands, which extend from their point of union, at the proximate end of the partitions, to the inner edge of the marginal muscle, the folds or lobes gradually enlarging toward the distal end; each of these lobes constitutes a single genital sacculæ; the digitiform bodies, in a single row, very far apart, extend from near the proximal end of each band a little more than half its length: the horizontal membrane which forms the claustrum in which the genital bands are confined is excessively thin and very extensible: pedicel muscles four very thin cords, not easily detected on account of their transparency, imbedded in the gelatiniform mass, between the distal corners of the camerae:



principal muscles of the disc broadly ligulate, gradually widening from their proximal ends to the termination of the arms where they are as broad as the tentacular tufts: marginal muscle very broad and very thin, doubled longitudinally, and, projecting considerably beyond the margin of the aboral side, completely hides from direct view the marginal anchors when the animal is looked at from the oral side; it suddenly thins out to a mere film at the bases of the tentacles: gelatiniform layer of the aboral side quite thick and uniform from the junction with the pedicel to the margin where it abruptly terminates; from its inner to its outer surface equal to the basal diameter of the largest tentacles; in the pedicel exterior to the cameræ it is one quarter thicker than in the bell, but no thicker than the latter in the base; between the four apertures of the pedicel cameræ, it projects considerably in the form of a boss, from which a thick ridge extends to the proximal end of each partition; the fibroid bodies arranged very much like those in *Halicylistus auricula*: lasso-cell groups or pockets scattered here and there over the oral side. Size; bell one quarter of an inch in diameter, and three eighths of an inch high including the pedicel. Geographical distribution; a single specimen was found in September, 1862, at Chelsea Beach, Mass., along with *Halicylistus auricula*, attached to *Zostera marina*, at half tide.

CRATEROLOPHUS.\* H. James-Clark.†

Disc octohedral, campanuliform; arms produced; pedicel monocamerous, the camera possessed of ridges which form

\* Κρατήρ, a cup; λόφος, a tuft.

† A species of *Lucernaria* from Heligoland described by Mettenheimer. Ueber den Bau und das Leben einiger wirbel. Thiere, &c. Abhandl. Senkenberg. Naturf. Gesell. Frankfurt, 1854, p. 15, plate I. fig. 5-11, is generically unlike any other, except, perhaps, the *Lucernaria convolvulus*, Johnston, and therefore for the sake of uniformity, I am obliged to characterize a genus, without having seen the animal, and from the written description of Mettenheimer.

a cruciate figure at its base; tentacles in groups at the end of the arms; anchors none; genitals tubiform with blind-sacklike divisions; pedicel muscles correspond to the four ridges in the camera.

CRATEROLOPHUS TETHYS. H. James-Clark.

"*Lucernaria*. (n. sp. ?)" Mettenheimer loc. cit. ut sup. Disc deeply campanuliform, tapering into a long pedicel; the arms very prominent, equidistant; the marginal intervals or sinuses round: pedicel thick, more than one half as long as the bell, the base large and broad: tentacles slender: genitals extend from the pedicel to the margin of the bell, the approximated halves very close to each other: the margin of the bell is beset by a row of lasso-cell groups or pockets, which extend also in a double row from each of the four corners of the mouth to the marginal sinuses. Size,  $1\frac{1}{2}$  inches long including the pedicel. Geographical distribution: Heligoland Is., North Sea. Mettenheimer. Collected in August.

? CRATEROLOPHUS CONVULVULUS. H. James-Clark.

*Lucernaria convolvulus* Johnston Mag. Nat. Hist. January, 1835, p. 59, fig. 3.

" " Dujardin in Lamk. An. sans Vert. 2d ed. 1840, tom. 3, p. 59.

*L. campanulata* Johnst. Brit. Zoöph. 1838, p. 231, fig. 37, (excl. synonym. Lamx.)

" " " " " 1847, 2d ed. p. 248, (excl. synonym. partim.)

" " Greene Nat. Hist. Review; Proc. Soc. 1858, p. 132.

Judging from Johnston's figures, as well as his description, in the first citation,\* the most ostensible difference be-

\* My determination of the character of this species is based purely upon Johnston's original description, published in 1835, in the Mag. Nat. Hist. In the

tween this species and the last, is that this has an exceedingly short pedicel, consisting merely of a very broad disciform base which is attached to the bell by a deep constriction; the tentacles are also said to be short, but this is rather a vague term, especially as the figures represent them as long as in some other species of *Lucernariæ* in which they can only be called long. The color is so variable among these animals that it cannot be used as a mark of distinction. Size, about an inch in height. Geographical distribution: Berwick Bay, east coast of Scotland, Johnston; Tor Bay, south coast of England. May, 1833, Coldstream.

MANANIA.\* H. James-Clark.

Disc urnæform, octohedral; the arms produced: pedicel monocamerous; the camera simple: tentacles in groups at the end of the arms, but a little within the muscular margin of the bell; outer or distal row pistilliform; the radial diameter of the groups greater than the transverse: marginal anchors pistilliform, situated just within the muscular margin: genitals transversely folded, terminating at a greater or less distance from the margin of the bell; the digitiform bodies accompany the united bands across the proximal end of the partitions: muscles of the pedicel four, equidistant, imbedded in the gelatiniform layer: principal muscles of the disc ligulate; from each side of the proximal end of a partition one extends in a direct line to

British Zoöphytes the description is modified so as to correspond with the *L. campanulata*, Lamx, with which he mistakenly identifies the originals. Curiously enough too, *L. campanulata*, Lamx, belongs not only to a different genus, but also to a different family from the *L. convolvulus*.

\* As in the case of *Calvadosia* and *Haliclystus salpinx*, I am indebted to Mr. Stimpson for specimens of this genus, which he collected near the island of Grand Manan, off Eastport, Maine. Unfortunately he made no written notes upon it while it was in a living state, but he tells me that he identified it at the time with the *Lucernaria auricula*, Fabricius, as described by that author in his *Fauna Grönländica*; and this is the same conclusion I have come to independently.

the end of the nearest arm: marginal muscle ligulate, powerful, forming a ring of uniform breadth and thickness, uninterruptedly, all around the margin of the bell, just outside the anchors and the tufts of tentacles: gelatiniform layer variable in thickness in the bell, uniform in the pedicel.

MANANIA AURICULA. H. James-Clark.

- Lucernaria auricula* Fabr., Fauna Grönland, 1780, p. 341.  
 " " Gmelin, Linn. Syst. Nat. 13th ed. 1788, p. 3151.  
 " " Steenstrup, Videnskbs. Meddl. Nat. Hist. For. Kjöbnh. 1859, p. 108, (exclus. synonym. Sars.)  
 " " Sars, Skandinav. naturforsch. möde i Kjöbenhavn, 1860, p. 693.  
 " " " Aftryk af Videnskab. Forhand. i Christiana, 1860, p. 6.\*  
 " " Leuck. Bericht Wieg. Archiv, 1861, 2d bd. p. 331.  
 " " = *L. typica* Greene, Leuck. Wieg. Archiv, 1860, p. 205.  
 " " Keferstein, Siebold und Kölliker, Zeitsch. June, 1862, (exclus. synonym. Sars Bidrag.)  
*L. typica* Greene, Nat. Hist. Rev. Proc. Soc. 1858, p. 132.  
*L. sp.* Sars, in note under *L. auricula*, J. Rathke, (non Fabr.) Reise i Lofoten. Nyt. Mag. 1860, p. 144.  
*Holothuria lagenam referens*, &c. Müll. Prod. Zoöl. Dan. 1776, No. 2812.

\* I quote this synonym here notwithstanding the apparent disagreement in Sars' diagnosis "organa generationis octo æquidistantia" which is intended doubtless merely as the opposite to the "radii binis approximatis; organa generationis octo per paria approximata" of *L. quadricornis*.



The urn much deeper than broad, passes into the pedicel abruptly from a rounded base; the arms about as broad as long, recurved: pedicel much longer than the urn, slender, gradually tapering to the end, where it suddenly expands into a moderate disciform base; the camera four sided, it occupies the middle half of the diameter of the pedicel, opens broadly into the cavity of the disc, and gradually tapers, in the same proportion as the pedicel, until at the base it abruptly expands with the latter: tentacles thirty-six, (60 et ultra, Fabr.,\*) in each group, the taxis and the rate of radial and transverse development the same as in *Halimocyathus platypus*; the globose knob distinct from the moderately slender shaft; the thickening of the pistilliform tentacles near the base of the shaft, on the distal third of the circumference: the marginal anchors have the same form as the pistilliform tentacles, but they are a little smaller than the latter: genital bands † twelve or fourteen times transversely folded, broadly ligulate, gradually narrowed at the proximal end to one half the breadth of the distal and middle portion; the digitiform bodies in a single row extend across the proximal junction of the bands and along three quarters of their length; the membrane of the genital claustrum, thin but not filmy: the muscles of the pedicel close to the inner wall, trans-

\* Fabricius' specimens, at least some of them, were larger than those to which I have access, but I have drawn up the description from the latter, and added one or two sentences from Fabricius in such cases as when his diagnosis differs from mine. [Since writing the above I have examined Greenland specimens, as large as Fabricius', which Mr. Stimpson received from Steenstrup, and I find them identical with the Grand Manan ones in every particular.]

† Rathke and those who have followed him in identifying this Lucernarian with his *Lucernaria auricula*, have overlooked the statement of Fabricius in regard to the genitals, (intestines he calls them,) which is, "De ventriculo in singulum par tuberculorum prodit intestinum nigrum 2—plicatum spirale, versus tubercula integrum, versus collum vero aperturis 2 terminatum," a feature which distinguishes this family from that to which Rathke's *L. auricula* belongs, in which the diagnosis should be, in singulum tuberculum prodit intestinum simplex, using the same terms as Fabricius.

versely semicircular, thin, minutely longitudinally folded, the concave side of each one facing one of the flanks of the quadrate camera; the edge of each limb of the semicircle two or three times deeply folded lengthwise; the breadth of each muscle rests against the middle of each flank of the camera; just above the base of the pedicel each muscle is nearly as broad as the corresponding flank of the camera, but at the base the muscle expands very little, whilst the camera suddenly widens to a far greater extent; and in the opposite direction, toward the urn, the muscle retaining the same breadth, the camera gradually broadens, until each flank is at least three times as broad as the muscle; and finally, when the muscle rather suddenly narrows, by one half, just before it enters the proximal end of a partition, the disproportion is still greater; radially the muscles occupy about one half the thickness of the gelatiniform layer: the principal muscles of the oral side of the urn narrow-ligulate, thin; each one extends to the base of a tentacular tuft, a little to one side of the middle line of an arm, and next the marginal sinus opposite a corner of the mouth; the marginal muscle very wide, nearly as broad as the radial diameter of a group of tentacles; it is imbedded in the middle of a considerable thickening of the musculo-gelatiniform layer, and is quite thick itself, but thins out on each edge, one of which borders close on the distal base of the pistilliform tentacles and the anchors, whilst the other terminates with the musculo-gelatiniform layer close to the edge of the aboral side: gelatiniform layer almost imperceptible in the aboral side, except at a short distance from its junction with the pedicel, where it gradually thickens and merges into that of the latter; in the pedicel it is very thick, being in this respect about twice the basal diameter of the largest tentacles; in the base of the pedicel it grows thinner, and at the under side of the disc it is less than one quarter of its greatest

thickness; the fibroid bodies diverge from the corners of the camera directly to the outer surface of the layer; some go to the nearest point in the surface, and others extend to the extreme distance opposite to, and even beyond the middle of a muscle, so that those from two adjoining corners cross each other between the muscle and the surface of the layer, but none of the fibroid bodies go from the muscles to the surface; on the concave side of the muscles the fibroids diverge at all points of the flank of the camera and, crossing each other at all angles, terminate against the proximal face of the muscles: depressions or pockets containing lasso-cells frequent upon the oral side, especially about the base of the arms. Size, three quarters of an inch high, including the pedicel. Geographical distribution: Greenland, Fabricius, Steenstrup, Sars; Lof-foden Is., Norway, Sars, in summer of 1849; Eastport Harbor, Maine, Stimpson, August.

CARDUELLA.\* Allman, (1859,) 1860. (Emendat. H. J. C.)

Disc urnæform, perfectly circular; arms none; pedicel tetracamerous; tentacles placed in eight distinct equidis-

\* By exchange, for our common Lucernarian, *Haliclystus auricula*, H. J. C., I have obtained from Professor Allman a couple of specimens of this remarkable genus. Fortunately the specimens are much older than the ones from which he drew up his description, and more in accordance with Sars' representations, and the specimens which he has lately sent to me. It would seem that Allman was unaware that Sars says that the tentacles are in three rows. "Diese bilden in jedem Büschel etwa 3 unregelmässige Reihen; bei jungen Individuen, die auch eine geringere Anzahl Tentakeln haben, nur 2 Reihen;" probably he based his identification upon the Latin diagnosis as copied in Johnston's *Zöophytes*, 1847, p. 475, although even there the "tentaculis sæpissime in fasciculis fere continuis ad marginem corporis dispositis;" would hardly warrant him in identifying it with his diagnosis, which says "tentacles capitate, *not tufted*, springing from within the margin of a circular disc *in a single series*." The italics in both quotations are my own. Really Gosse's *Depastrum*, as he has described it, is more nearly related to Sars' *L. cyathiformis* than is Allman's *Carduella*, as the diagnosis now stands; and I myself am very much inclined to believe that *Depastrum* is an adult *L. cyathiformis*, whilst I have no doubt that *Carduella*, as it now is understood in books, is the young of the latter. See note under *Depastrum*.



tant groups within the margin of the urn, and arranged in rows parallel to the margin, those in one row alternating with those in the next, and successively diminishing in size from the central to the outermost ones; the radial development less than the transverse; between every radial row the oral and aboral sides of the urn are united by a thin septum, so that the interior of the tentacles communicates with the quadrant cameræ of the urn, through short radiating passages: the marginal anchors are single tentacles whose cavity opens between a pair of septa like those at the base of the tentacles; they are set up higher and nearer to the edge of the urn than are the tentacles: the approximated genital halves, with their respective claustra, extend half way or more toward the edge of the urn, transversely plicate; the digitiform bodies border the whole length of the bands: pedicel muscles four, alternate with the cameræ; principal muscles of the oral side of the urn pennate, the partitions forming the line of divergence; marginal muscle a single ligulate ring, forming a continuous, thickened projecting brim to the urn, outside the tentacles and anchors: gelatiniform layer conspicuous, varying in thickness in the urn and pedicel.

CARDUELLA CYATHIFORMIS, Allman.

*Carduella cyathiformis*, Allman, Rep. Brit. Assoc.  
(Aberdeen 1859), 1860, p.  
143.

“ “ Allman, Mic. Jour. Trans.  
1860, VIII. p. 125, Pl. V.

“ “ Allman, An. Mag. Nat. Hist.,  
July, 1860, VI. p. 40.

*Calicinaria cyathiformis*, Edw. et Haime, Hist. Corall.,  
1860, tom. III. p. 460.

*Depastrum cyathiforme*, Gosse, An. Mag. Nat. Hist. 1860,  
June, p. 481.



*Lucernaria cyathiformis*, Sars, Fauna Litt. Norveg. 1846,  
p. 26, pl. 3, fig. 8-13.

“ “ Sars,\* Aftryk af Vidensk. For-  
hand. i Christiana, 1860, p. 7.

“ “ Sars, Skandinav. Naturforsch.  
möde i Kjöbenhavn, 1860, p.  
693.

“ “ Greene, Nat. Hist. Rev. Proc.  
Soc. 1858, p. 132.

“ “ Keferstein, Siebold und Köl liker,  
Zeitsch. June, 1862, (exclus.  
synon. Gosse Synop. Actin.?)

The body † “ where it joins the stem, is bellied, becomes farther above somewhat constricted, and at the uppermost end again widened, whilst the margin spreads itself outwardly round about;” as long as the pedicel: the pedicel “cylindrical, slender” abruptly expanded into a broad disciform base; the four cameræ very large, widened in the base of the pedicel, rather abruptly narrowed just before they open into the cavity of the urn, oblong ovate in a transverse section; they nearly meet at the centre of the pedicel, of the radius of which the greater diameter of each camera occupies about four fifths, the lesser diameter

\* In the diagnosis which Sars gives in the above cited paper, he says, “*corpuscula marginalia nulla*,” but as he immediately afterwards remarks that “This remarkable form, which, perhaps, rightly forms a peculiar genus (*Carduella*, Allman”) separated from the other *Lucernarians*,” &c., &c., and prefaces his diagnosis by reference to the *Fauna Littoralis* and *Carduella cyathiformis*, Allman, Quart. Journ. Mic. Soc., April, 1860, in both of which papers marginal corpuscles are certainly described, I can only believe that Sars has made a slip of the pen, or that he means to say these bodies being identical with the tentacles, cannot be considered in the light of marginal bodies or anchors. In the second paper quoted he also says, “*L. cyathiformis*, Sars, which lately has been offered as a new genus, under no less than three names: *Depastrum*, Gosse; *Carduella*, Allman; and *Calicinarina*, Milne Edwards.” Sars has lately sent me specimens of all ages, which certainly have the “*corpuscula marginalia*.”

† As my specimens are alcoholic preparations, I quote from Sars' *Fauna Litt. Norveg.* in regard to such features as are observable only in a living state.

of the same being only one half the greater : tentacles 12–15 in each bunch, “filiform, of moderate length, and proportionately much thicker than in *Luc. quadricornis*,—and ending in a thicker globular knob,” the groups very close together, separated by a short interval in which the marginal anchor is situated,—in at least four rows; four in each of the three outermost rows, those in the fourth inner row very young; in each tuft, those in the next to the outer row the largest, “those situated in the inner row are turned outwards, those in the outer one with their ends bent down around the tolerably thick margin of the body,” the basal septa, between which their channels open, do not reach beyond the inner or proximal row of tentacles; their position is recognized from the aboral side of the urn by radiating furrows extending from the edge of the gelatiniform layer a short distance toward the pedicel; those on each side of the anchors extend much beyond their base, and opposite the four partitions of the urn nearly close up the passage between the cameræ: marginal anchor purely tentacular, much smaller than the tentacles, its base nearer to the margin than is that of the outer row of tentacles, and partially overlying the marginal muscle: genital bands extending about half way to the margin of the urn, ligulate, 6–8 uniserial saccules in each band; the digitiform bodies arranged in a single row from one end of the bands to the other, and across their proximal junction; the membrane of the claustrum comparatively thick, and at least twice as wide as the two enclosed genital halves together:\*

\* In Allman's transverse section of a young *Carduella*, (Mic. Journ. &c., *ut sup.*) the approximated halves of the neighboring genitals are represented as if they were one band, and there is no indication of a *claustrum*; this I can only account for by supposing that the section was made just at the point where the distal ends of the bands become confluent, as is the norm in this family, and where also the claustral membrane merges into the oral side of the urn. I am well aware that Allman calls them “four generative bands,” but I cannot view them as such, and on the contrary I consider them as the closely approximated halves of adjoining genitals; each claustrum therefore encloses not a single genital, but the two halves

pedicel muscles very large, equally trihedral, with slightly convex sides ; at the base of the pedicel they extend from the axis to very near the surface, terminate truncately, and each occupies about one eighth the whole area, the camera, each respectively filling up the other four eighths ; passing toward the urn the muscles gradually diminish their radial diameter, and just before they enter the proximal ends of the partition of the urn they narrow rapidly to a much less diameter : principal muscles of the oral side of the urn uniformly pennate, the fibrillæ diverging symmetrically on each side of the partitions ; marginal muscle imbedded in the distal side of the greatly thickened musculo-gelatiniform layer, which forms the raised border ; the muscle is very broad, its breadth equal to the length of the tentacular anchors ; at its free margin it is very thick, and gradually thins away to a sharp edge at the junction with the termination of the aboral side : gelatiniform layer of the aboral side of the urn moderately thick, nearly uniform, being slightly thinned toward the pedicel, but thickening again farther along, and passing into the pedicel retaining about the same incrassation exterior to the region occupied by the cameræ and muscles, until at the base it abruptly becomes thinner by two thirds ; at the axis of the pedicel it is thickest where the cameræ and muscles are thinnest, and projects a short distance between the cameræ, but the contact of the sides of the latter and the muscles prevents it from communication with its peripheral portion : two irregular rows of large lasso-cell pockets extend from the distal end of the genitals toward the margin of the urn. Size " $\frac{1}{2}$  seldom  $\frac{2}{3}$  of an inch long ; of which the cylindrical thin stem forms the one, and the beaker-form body the other half." Geographical distribution : coast of Norway, Sars ; Orkney Is., Allman.

of different genitals, and this my prolonged investigations, for the past two years, have induced me to consider as the peculiarity of the type of this family.



DEPASTRUM.\* Gosse, 1858.

According to Gosse's diagnosis and figures, this genus is distinguished from *Carduella*, as I have characterized it,

\* Since I have had an opportunity to examine specimens of *Carduella*, I have compared it with the descriptions of *Depastrum* as given by Gosse in "*The Aquarium*" and in his reclamation in the *An. Mag. Nat. Hist.* 1860, V., for June, and with Allman's answer to the latter, from which I gather but one fact, or at most two, which can now separate the two genera, and these are, in *Depastrum* there are no marginal anchors, and the tentacles arise at the margin of the disc or without it. I offer the following suggestions and facts which have occurred to me to be explanatory of what seem to be only such differences as may be exhibited by any one individual. In the first place, in Sars' *Fauna Litt. Norvegica*, Pl. 3, fig. 13, there is a distinctly octagonal area with a sharply defined boundary, the corners of which correspond to the intertentacular spaces, and the sides to the groups of tentacles which are without their margin; the marginal anchors are reverted and inconspicuous, so that the prominent features are the octagonal area, and the groups of tentacles outside the so-called margin are almost perfect counterparts of Gosse's figure in the *Annals and Magazine* 1860, V. p. 481, fig. 3. Now in *Carduella*, as I find and have described above, the margin of this octagonal area corresponds to the inner or proximal ends of the short septa at the bases of the tentacles and the marginal anchors, and which unite the oral and aboral sides of the disc; but within this margin the two sides are free from each other, and very naturally form a distinct fold along the line of separation, which fold constitutes an octahedral figure with prominent angles. It is very easy to see now that if the marginal muscle contracts in such a way as to revert the edge, as often I have seen done in other *Lucernarians*, and at the same time constricts the urn below, the octagonal area will inevitably become prominent; and this I suspect strongly is the condition of the animal figured in profile by Gosse. (*An. Mag.* 1860, V. p. 481, fig. 2.) I would say also that it seems to me there must be a marginal muscle *outside* the tentacles in Gosse's animal, else how could the neck of the urn become so deeply constricted? My dissections have taught me that the marginal muscle of *Lucernarians* is the extreme border of the oral side, without which the tentacles do not originate, although they may arise close to its distal edge as obtains in *Halimocyathus*. When, therefore, Gosse speaks of the tentacles springing from the margin or without it, I take it that the margin is that of the octagonal area, and not the true margin. The only serious objection to identifying the two genera is that *Depastrum* has no marginal anchors, according to Gosse. Now it is notable, that Gosse's figure represents the animal in a contracted state, the peduncle is strongly corrugated, the urn is deeply constricted, and the tentacles are very short and thick set, as if, (and very probably), contracted. All this might arise from an unhealthy state of the animal; and Gosse remarks, that his specimen, after being detached, did not reflex itself, but laid at length on the bottom of the vessel in which it was placed. In an unhealthy state the thick layer of lasso-cells of the knob of the tentacles falls away very readily, and next sloughs off the outer wall of the shaft, thus leaving the thick musculo-gelatiniform layer exposed. Now if this were to happen to the short marginal anchors of *Carduella* there would



by the following features : "disc octagonal ; the tentacles spring from the margin or without it ;" no anchors.

## DEPASTRUM CYATHIFORME. Gosse.\*

*Depastrum cyathiforme*, Gosse, An. Mag. Nat. Hist. 1858,  
Vol. I. June, p. 419.

" " Allman, An. Mag. Nat. Hist. 1860,  
Vol. VI. July, p. 41.

" *stellifrons*, Gosse, An. Mag. Nat. Hist. 1860,  
Vol. V. June, p. 481, figs. 1,  
2, 3.

*Lucernaria cyathiformis*, Gosse, [non Sars,] The Aquarium,  
(2d ed.) 1856, p. 85.

" " Johnston, Brit. Zoöph. (2d ed.)  
1847, p. 475, fig. 86.

" *stellifrons*, Keferstein, Siebold und Kolliker,  
Zeitsch. June, 1862, p. 25.

Geographical distribution : Weymouth, Southern England, Gosse.

## Family. ELEUTHEROCARPIDÆ. H. J. C.

LUCERNARIA. Müll. Prod. Zoöl. Danica, 1776, p. XXIX.†

Type, *L. quadricornis*, Müll. Prod. Zoöl. Danica, 1776,  
p. 227. Disc broad funnel-form ; the eight arms elongate,

be left this transparent musculo-gelatiniform layer projecting in a point from every corner of the octagonal area, and simulating completely the sharply-pointed disc of Gosse's figures of *Depastrum*.

\* If this is truly different from Sars' *Lucernaria cyathiformis* the synonymy will be as I have given it, and the name *stellifrons* must be suppressed, for the former has priority in the genus ; and if, on the contrary, it should prove to belong to the same genus as the *L. cyathiformis*, it can only be so by really possessing marginal anchors ; and this I suspect is all that is needed to make it *specifically* the same as *L. cyathiformis* ; so that in the latter case it would also remain as *D. cyathiforme*, and *Carduella* become a synonym from sequence in date.

† It appears that Edwards and Haime, (Hist. Corall. III. 1860, p. 457,) who credit the genus *Lucernaria* to Fabricius, have overlooked the fact that Müller, in the introduction of his *Prodromus*, under the head of "CHARACTERES VERMIUM," p. XXVII. in the 3d div. "MOLLUSCA," \* \* \* "Ore infero," p. XXIX. has charac-

in closely approximated pairs,\* so that the oral side of the disc appears quadrate: pedicel monocamerous: tentacles in groups on the end of each arm; radial and transverse development of each group equal: marginal anchors none: genitals transversely folded bands which extend to the end of the arms: muscles of the pedicel four, equidistant, projecting like ridges or pilasters† from the surface of the camera: the principal muscles of the disc ligulate, each one extending from the proximal end of a partition to the end of an arm: marginal muscle ligulate, very thin at the base of the tufts of tentacles: gelatiniform layer thin in the disc, moderately thick in the pedicel.

LUCERNARIA QUADRICORNIS. Müller.

- Lucernaria quadricornis*, Müll. Prod. Zoöl. Dan. 1776, p. 227, No. 2754.
- “ “ Müll. Tegninger til Zoöl. Dan. Förste Hæfte, Kiöbenh. 1777, tab. XXXIX. Fide Fabr. Faun. Grönl. 1780, p. XVI. and 342.
- “ “ Müll. Zoöl. Dan. 1788, Vol. I. p. 51, Pl. 39, fig. 1-6.
- “ “ Gmelin Linn. Syst. Nat. 1788, tom. 1, pars. VI. p. 3151.

terized his genus, "Gelatinosum, rugosum, brachiatum," and refers to page 227 for the description of the species. *L. quadricornis* was the first and only species ever described by Müller, and therefore was the type, and must be retained as the type of the herewith restricted genus *Lucernaria*.

\* In all *Lucernariæ* the arms are more or less approximated toward the partitions, probably because thereabouts are situated the more powerful muscles; but in this genus the approximation is not only close, but also evidently permanent, and moreover the intertentacular sinuses opposite the partitions are only half as deep as those which alternate with them.

† These are altogether different from those in the pedicellar camera of *Calvadosia*, in which the pilasters are totally devoid of muscular structure, and are composed entirely of gelatiniform substance.

- Lucernaria quadricornis*, Lamarck, Syst. An. sans Vert.  
1801, p. 354.
- “ “ Lamarck, Anim. sans Vert.  
1816, tom. 2<sup>me</sup>. p. 474, (excl.  
syn. Fabr.)
- “ “ Lamarck, Anim. sans Vert.  
1840, 2d ed. tom. 3<sup>me</sup>. p. 58,  
(excl. synonym. Fabr.)
- “ “ Lamx. Mem. Mus. Hist. Nat.  
Paris, 1815, tom. 2<sup>me</sup>. p. 471.
- “ “ Cuvier, Regne Animal, Vol.  
IV. 1817, p. 53.
- “ “ Cuvier, Regne Animal, Vol.  
III. 1830, 2d ed. p. 294.
- “ “ Deslongchamps, Encyclop. Me-  
thod. Zoöph. tom. 2, 1824,  
p. 499. Pl. 89, fig. 13-16.
- “ “ Sars, Bidrag til Södyrenes  
Natur. Bergen, 1829, p. 43,  
Tab. 4. Translated in Oken's  
Isis, 1833, p. 229.
- “ “ Sars, Fauna Litt. Norvegica  
1846, p. 20. Pl. 3, fig. 1-7.  
(Excl. syn. Fabr. *L. auricula*.)
- “ “ Sars, Aftryk af Videnskabs-  
selskabets Forhandlinger i  
Christiana, 1860, p. 6.
- “ “ Sars, in Leuck. Bericht, Wieg-  
Archiv, 1861, 2d bd. p. 332.
- “ “ Blainville, Manuel d'Actinolog.  
1834-36, p. 317.
- “ “ Johnston, Brit. Zoöph., 2d ed.  
1847, p. 252.
- “ “ Stimpson, Marine Invertebrata

- of Grand Manan. Smithson.  
Contrib. 1853. Apart. p. 8.
- Lucernaria quadricornis*, Carus, Icones Zoöt. 1857.  
Taf. IV. figs. 1, 2.
- “ “ Gosse, An. Mag. Nat. Hist.  
June, 1858, p. 419.
- “ “ Edw. et Haime, Hist. Corall.  
1860, tom. 3, p. 459.
- “ “ L. Agassiz, Contrib. Nat. Hist.  
N. Am. 1862. IV. p. 175.
- “ “ Keferstein, Siebold und Kölliker  
Zeitschrift, June, 1862, p. 20.
- L. fascicularis*, Fleming, Mem. Wern. Soc. II. 1814, p.  
248. Pl. 18, figs. 1, 2, translated in  
Oken's Isis, 1832, p. 764. Taf. XIV.  
figs. 1, 2.
- “ “ Fleming, Hist. British Animals, 1828,  
p. 499.
- “ “ Lamx. Mem. Museum Hist. Nat. Paris,  
1815. II. p. 470.
- “ “ Ehrenb. Corallenthiere. Abhand. Berlin  
Akad. 1834, p. 267.
- “ “ Johnston, Brit. Zoöph. 1838, p. 228.
- “ “ “ “ “ 1847, 2d ed., p.  
244. Pl. XLV., figs. 3-6.
- “ “ Frey und Leuck. Beiträge Wirbellosen  
Thiere, 1847, p. 9. Pl. 1, fig. 3.
- “ “ Green, Nat. Hist. Rev. 1858. Proc. Dub-  
lin Univ. Assoc., Zoöl. & Bot. p. 132.

The disc very pliable and flaccid, owing to the very slight development of the gelatiniform layer in the aboral side; the apex being prolonged, a pseudo-pedicle is produced which gradually tapers into the pedicle: the eight tentaculiferous arms about twice as long as their basal breadth; the intertentacular marginal sinuses opposite the



corners of the mouth, twice as deep as those alternate with them: the pedicel slender, tapering toward the base, about as long as the semidiameter of the disc; the pedicellar camera circular, and subdivided into four lateral spaces by the four large muscular pilasters, opens broadly into the cavity of the disc: tentacles 100–120 on each arm in adult, in half-grown individuals as many as fifty, very slender: genital bands linear lanceolate; the proximal ends come close down to the top of the pilaster-like muscles of the pedicel, but do not approximate each other; their distal ends terminate between the middle and the edge of the arm, next the greater marginal sinus, and close up to the base of the tentacles; the genital sacculles are very numerous, about as large as those of *Halicystus auricula*; they are largest at the proximal end, and gradually diminish toward the distal end; digitiform bodies larger than the tentacles, at the proximal end of the double rows, but gradually diminish until at the distal end of the rows they are only one fifth as long; they extend only one third the length of the genital bands from the proximal end of the latter, distally: the four pilaster-like pedicel muscles about one fifth the diameter of the pedicel, circular, attached by a narrow strip along the face of the camera: the muscles of the disc narrow ligulate, each one terminating at the middle of the end of an arm; marginal muscle thick and narrow ligulate: gelatiniform layer hardly perceptible in the disc, but in the pedicel about one third as thick as the diameter of a muscular pilaster. Size, 2" broad, 2"–2 $\frac{1}{3}$ " long, Sars; "nearly three inches in length," Stimpson. Geographical distribution: Denmark, O. F. Müller, Steenstrup; Coast of Norway, 2 ft.–20 fthms, Sars; \* Zetland,

\* While the above was in press, I received a full-grown Norwegian specimen from Sars, by means of which I am enabled to add somewhat to the proofs. I find it is identical with one which Mr. Stimpson received from Greenland, through Steenstrup, and also the same as one, three inches high, which the former found at Grand Manan.

4-7 fthms, Forbes, Fleming; Farøe Is., Steenstrup; Greenland, Ehrenberg, Steenstrup; Grand Manan Is., Bay of Fundy, and Owls Head, Maine, Stimpson; \* "Mass. Bay, Agassiz and Gould."

CALVADOSIA.† H. James-Clark.

Disc infundibuliform; the eight arms nearly equidistant, prominent: pedicel monocamerous with four equidistant rounded pilasters: tentacles in groups on the end of the arms close to the aboral edge; outer row pistilliform, and having the same function as the anchors in other genera; radial and transverse diameter of the group equal: anchors none: genitals, transversely folded bands extending to the end of the arms; the digitiform bodies alone extend across the proximal end of the partition: muscle of the pedicel a continuous thin layer of transversely disposed fibrillæ, forming a cylinder between the outer and inner walls, and imbedded in the gelatiniform layer: the principal muscles of the disc ligulate, each one extending from the proximal end of a partition to the end of an arm; marginal muscle ligulate, moderately thick, but at the outer base of the tufts of tentacles very thin: gelatiniform layer thickest at the edge of the disc, but thins out almost entirely half way toward the pedicel, and then in the latter grows thick again where it is divided into two layers or concentric cylinders by the intervening muscular cylinder; the four pilasters are also gelatiniform, and not muscular, as are the pilasters in the pedicel of *Lucernaria quadricornis*.

\* I am indebted to Mr. Stimpson for the permission to dissect a small specimen of this species, about an inch high, which he obtained at Owls Head, Maine.

† I am indebted to my friend William Stimpson, Esq., for the privilege of making the anatomy of this genus; the specimen, *Lucernaria campanulata* Lamx. (non Johnston,) was collected by him at Milford Haven, South Wales, in September, 1862, during an extensive dredging excursion, along the western coast of Great Britain. [Whilst this was in press, I also received a specimen from Keferstein, which he collected at St. Vaast la Hougue, France;—it agrees in all particulars with the Milford Haven specimen.]

CALVADOSIA CAMPANULATA. H. James-Clark.

*Lucernaria campanulata*, Lamx. (non Johnst.) Mem. Museum, 1815. II. p. 460, Pl. 16, fig. 1-7.

“ “ Gosse, An. Mag. Nat. Hist. 1855. XVI. p. 313.

“ “ Edw. et Haime, Hist. Corall, tom. 3<sup>me</sup> 1860, p. 458, (excl. syn. Johnstoni), Atlas. Pl. A, 6.

“ “ Leuck. Bericht, Wieg. Archiv, 1861, 2d bd. p. 332.

“ “ Keferstein, Zeitsch. Wissenschft. Zoöl., Siebold und Kolliker. June, 1862, p. 23, taf. 1, fig. 4, etc., (excl. syn. Montagu, Lamk. Johnston).

*L. auricula*, Milne Edw. Cuvier, Regne Animal, 3d ed. Atlas. Pl. 63.

“ “ ? Templeton, Mag. Nat. Hist. 1836. IX. p. 304.

*L. inauriculata*, Owen, Rep. Brit. Assoc. (Birmingham, 1849,) 1850. 2d pt. p. 78.

“ “ Greene, Nat. Hist. Rev. Vol. V. 1858, Proc. Soc. p. 132.

The infundibuliform disc gradually tapers into the pedicel; the arms much longer than broad: pedicel camera circular between the pilasters, opens widely into the cavity of the disc; the pilasters nearly circular, attached by a broad portion of their circumference along the whole length of the camera, and tapering away to a point at the base of the mouth; in the centre of the base, on the exterior, a small round pit, of variable depth and proportions: the tentacles rather stout; the spheroidal tips much depressed at the end, very large in comparison with those of

other genera; the outer pistilliform tentacles smaller than those in the next two or three inner rows, thickened and humped on the exterior side, the proximal side as in the others: genital bands elongate lanceolate, the proximal ends of each pair almost touching each other across the axial end of the intervening partition, from which point they diverge and extend close up to the base of the tufts of tentacles; the base of the pedicel very broad; the muscular cylinder of the pedicel near the inner wall of the camera, at about one sixth the distance between the latter and the outer wall: principal muscles of the oral side of the disc narrow ligulate; one ligule accompanies each genital band, running close along its border between it and the partition from which it diverges; marginal muscle ligulate, thick in the middle, but thins out at both edges: gelatiniform layer at the margin of the disc about as thick as the base of a full grown tentacle, but it thins out to a mere film about two thirds of the way to the centre of the body, and then thickens again gradually toward the pedicel; in the latter its thickness is about one fifth the diameter of the camera; in the pilasters it comprises the whole of their substance, and is continuous with the inner division of the same substance in the main part of the pedicel, and in the thickest part of the pilaster has a diameter a little less than one quarter of that of the camera; the fibroid bodies of the inner division of the gelatiniform layer pass obliquely into the pilasters to their periphery, crossing each other promiscuously just within the paries of the same; the digitiform bodies extend a short distance along the tapering end of each pilaster: lasso-cell pockets scattered over the oral side. Size; the disc 1" across, and 1" deep; the pedicel  $\frac{5}{8}$ " long;  $\frac{1}{8}$ " diameter. Geographical distribution: Calvados, France, Lamouroux, Milne Edwards, Keferstein; Dover, England, Aug. 1849, Owen; Milford Haven, Wales, Sept. 1862, Stimpson in exped. collegit.



## HALICLYSTUS.\* H. James-Clark.

Disc umbellæform; arms more or less prolonged: pedicel tetracamerous: tentacles all alike, in groups at the end of the arms, the radial and transverse diameter of the groups equal: marginal anchors pistilliform, or fabæform: genitals double; the halves of each genital distinct from each other, the space between their proximal ends occupied by the digitiform bodies; each band extends to the base of the tentacles; the saccules distinct and prominent: pedicel muscles four distinct, equidistant cords, alternating with the four cameræ: principal muscles of the disc pennate, diverging on each side of the partitions; marginal muscle a band of varying breadth, very thin at the base of the tentacles and anchors: gelatiniform layer of varying thickness in the disc; very thick in the pedicel, occupying all the space not appropriated for the four cameræ and the four muscular cords.

## HALICLYSTUS AURICULA. H. James-Clark.

- Lucernaria auricula*, Rathke, (non. Fabr.) Müll. Zoöl. Dan. Vol. IV. 1806, p. 35, (exclus. synonym.). Pl. CLII.
- “ “ Montagu, Trans. Linn. Soc. 1808, p. 113 (exclus. Pl. VII. fig. 5.)
- “ “ Lamx. Mem. Mus., 1815, tom. 2d, p. 471 (exclus. synonym.), partim.
- “ “ Fleming, Hist. British Animals, 1828, p. 499 (excl. syn. Fabr.)
- “ “ Cuvier, Regne An. IV. 1817, p. 53.
- “ “ Cuvier, Regne An. III. 1830, 2d ed. p. 294.
- “ “ Johnston, Mag. Nat. Hist., Jan. 1832. V. p. 43, fig. 29.

\* Haliclystus; ἄλς, the sea, κλύζω, to dash upon.

*Lucernaria auricula*, Johnston, Brit. Zoöph. 1838, p. 229,  
fig. 35 (exclus. synonym. pars).

“ “ Johnston, Brit. Zoöph. 1847, 2d ed.  
p. 246, fig. 54 (exclus. synonym. pars).

“ “ Milne Edw. et Haime, Hist. Corall.,  
tom. 3<sup>me</sup>, 1860, p. 458 (exclus. syn-  
non. Müll., Prod.; Fabr. Sars.)

“ “ Auct. Anglicorum, H. J. C., Proc.  
Bost. Soc. Nat. Hist., March,  
1862, p. 47.

*Lucernaria octoradiata*, Lamarck, Anim. sans Vert. 1816,  
tom. 2d, p. 474.

“ “ Duj. in Lamk. An. sans Vert.  
2d ed. 1840, tom. 3d, p. 59,  
(exclus. synonym., “Blainv., Man.  
Atlas, Pl. 50, fig. 4,” and  
Lamx. Mem. MSS.)

“ “ Sars,\* Aftryk af Videnskabs For-  
hand. i Christiana, 1860, p. 6,  
(exclus. synonym. *L. auricula*,  
Bidrag. et Faun. Litt. Norveg.)

“ “ Sars, in Leuck. Bericht, Wieg-  
Archiv, 2d bd. 1861, p. 332.

“ “ Steenstrup,† Videns. Med. Natur.  
Foren. Kjöbenh, 1859, p. 108.

“ “ Steenstrup in Leuck. Bericht,  
Wieg. Archiv. 1861, p. 331.

The disc shallow umbellæform, strongly octangular;  
the arms as broad as long: pedicel rather thick, cylindri-  
cal, expanded moderately at the base, furrowed longitudi-  
nally at four equidistant places, corresponding to the four

\* Sars, to whom I had sent specimens of this species from our coast, in a recent letter, says it “is *L. octoradiata*. Lamk. (*L. auricula* Johnst. Sars olim, non Fabr.)”

† Steenstrup has sent, to Mr. Stimpson, Greenland specimens, which, upon direct comparison, I find to be identical with ours.

muscular cords, no pit in the base; the four camerae transversely ovate, connected with each other at the base by anastomosing channels, and slightly constricted above, just before opening into the cavity of the umbella; their greater diameter, trending radially, a little less than one third that of the pedicel; the space between them, at the axis of the pedicel, nearly one third the diameter of the latter; the space between every two, about double the breadth of a camera, and the distance of each from the paries of the pedicel one third its distance from the axis: tentacles from one hundred to one hundred and twenty, slender, their length equal to one fourth the diameter of the umbella; the globular tip slightly depressed at the end, its diameter from two to two and a half times greater than that of the cylindrical part of the tentacle: anchors reverted toward the pedicel; very large, oval or fabæform; each one attached to the margin by a short, broad stem, half as long and half as broad as itself; furrowed longitudinally on the proximal side like a coffee grain, which it resembles; length nearly equal to the diameter of the pedicel, those opposite the partitions usually longer than the others, breadth half as great; the original tentacular nature almost totally obscured by the enormous development of the adhesive cells in the outer wall, the head of the tentacle represented by a small group of lasso-cells near the distal end in a clear space, which has the deceptive appearance of being an opening; the internal cavity large, equalling from one third to one half the diameter of the whole organ; in unusually large individuals they are deeply wrinkled in every direction: the genitals consist each of two distinct bands, in the shape of broadly obtuse triangles, whose base, trending in a direct line to the arms, is twice as long as its height, and the apical obtuse angle projects into the area opposite the corner of the mouth; about one hundred and twenty-five saccules in each band,

which is at least three or four times as many as in the next two species, closely set together, reminding one of the pavement teeth of certain fishes; the youngest saccules always on the border next the partitions, from which side they gradually increase in size until they attain their maximum at the opposite edge; the distal end of each band nearly touches the end of the arm which it enters, but the proximal end terminates a short distance exterior to the proximal end of the partition; the digitiform bodies linear lanceolate, extend in three or four rows across the proximal end of the partitions, and a very short distance along the older border of each band: pedicel muscles transversely triangular, deeply and profusely furrowed longitudinally; on the proximal side three of the furrows are so deep as to divide the muscle into four great folds, which unite at the distal side, corresponding to the apex of the triangle; each cord arises from the pedicel base, where it stretches out to the centre, and gradually lessens in size as it approaches the disc; at the basal two thirds of the pedicel it is very near the outer surface of the gelatiniform layer, but in the remaining third it gradually approximates the axis of the pedicel, until, just within the entrance to the main cavity, it reaches the inner surface of the same layer, and then, in this relation, passing along a short distance, it enters the oral side of the disc at the proximal end of the corresponding partition; the diameter of a cord about one half the major diameter of a pedicel camera: the principal muscles of the disc are uniformly disposed layers, extending on each side of a partition to the margin of the genital bands, along the margin of the genitals so strongly developed as to appear like ligulate bands, as in *H. octoradiata*; the fibrillæ diverge at very acute angles from each side of the partitions, and, trending parallelwise with the edge of the genital band, extend to the marginal muscle; the minor muscles uniformly diffuse, the fibrillæ radiate



from the angles of the mouth to the marginal muscle; the marginal muscle ligulate, very thin at the distal side of the anchors and the tentacular tufts: gelatiniform layer of the disc about one quarter as thick as the diameter of the pedicel, rigid, a little thinner at the edge of the disc than toward its centre; at the end of the arms it suddenly becomes much thinner; in the base of the pedicel it is not more than one third as thick as in the disc; in all parts of the body, both disc and pedicel, the fibroid bodies of this layer stretch in a direct course from the outer to the inner surface; between the cameræ of the pedicel they cross each other at a wide angle, and also cross the axis at right angles to each other as they extend from diagonally opposite cameræ: the musculo-gelatiniform layer in the marginal anchors at least two thirds as thick as the gelatiniform layer of the disc; at the margin of the disc it is as thick as the gelatiniform layer at the same place, but it gradually lessens to one third this amount toward the mouth. Size, one inch across the disc, and one inch and a half including the tentacles; the pedicel half an inch long, one twelfth of an inch average diameter, and a little more than one eighth of an inch across the base. Geographical distribution: Vardöe Is., Norway, Rathke; Faröe Is., Steenstrup; English coast, Montagu, Fleming, Johnston, &c.; South coast of Greenland, Steenstrup; Anticosti Is., Gulf St. Lawrence, colleg. in exped. ex Mus. Comp. Zoöl., Camb., Mass., August, 1861, Messrs. Hyatt, Shaler, and Verrill; Mass. Bay, H. J. C.

HALICLYSTUS SALPINX. H. James-Clark.

This hitherto undescribed species is at once distinguishable from any other known Lucernarian by its remarkable trumpet-shaped marginal anchors. Mr. Stimpson, to whom I am indebted for the loan of specimens, and some sketches of the animal taken from life, says in his notes, that, "from

*Lucernaria octoradiata*, Sars, Videnskabs Forhand. i Christ., 1860, it differs by a stalk longer and not fading into body, suckers [anchors] longer and with more distinct tops, ovaries separate; color dark brown." The alcoholic specimens are singularly transparent, and, thanks to my friend's skill and experience, in a remarkably good state of preservation.

Disc octahedral, umbellæform, rather abruptly passing into the pedicel; the arms as broad as the intervals, broadly rounded at the end, their length less than their breadth: pedicel more slender and proportionately longer than in *H. auricula*, base slightly expanded, a small pit in the middle of the latter; the four camerae broadly ovate in transverse section, radial diameter to the transverse as  $1\frac{1}{2}$  to 1, and one fifth the diameter of the pedicel, from the surface of which they are situated at a distance that is a little more than their greater diameter: tentacles from sixty to seventy in specimens less than an inch in diameter, very slender; the globose tip comparatively smaller than in *H. auricula*, not depressed; taxis as in *H. auricula*, but the radial development of the rows apparently less than the transverse, so that the groups are broader than in that species: marginal anchors very prominent, as long as the arms, not reverted, slender, and obliquely trumpet-shaped; the edge of the trumpet considerably thickened, except at a narrow space on the proximal side, by the development of the adhesive cells; the centre of the terminal expansion occupied by a single tentacular remnant, about as long as half the breadth of the trumpet, and the globose tip half as thick as that of the tentacles: genital halves not as widely separate as in *H. auricula*, oblong obovate; the broader end projecting half-way into the arms; from forty to forty-five sacculs in each band, and uniformly of the same size in all parts of the organ, in four longitudinal rows, the marginal rows shorter than the middle rows, which

extend farther at each end;\* the digitiform bodies are arranged as in *H. auricula*: pedicel muscles oval in a transverse section, situated as in *H. auricula*: muscles of the disc as in *H. auricula*; marginal muscle broad ligulate, narrowest at the anchors, but gradually widens toward the arms, at the end of which it is very thin: gelatiniform layer very thin at the edge of the disc, but gradually thickens toward the pedicel, in which it has the same relations to the muscles and the cameræ as in *H. auricula*, but with different proportions, as may be judged from measurements of the cameræ given above: groups of lasso-cells in little depressions or saccules scattered here and there, on the oral side of the disc. Size, nearly one inch across the disc; pedicel half an inch long. Geographical distribution: "Dredged in 3 fthms on *Laminaria*, Mt. Desert Is., Maine, August, 1858," Stimpson.

*HALICLYSTUS OCTORADIATUS*.† *H. James-Clark*.

*Lucernaria octoradiata*, Sars, (non Lamck.) Skandinav.

Naturforsch. möde i Kjöbnh.,  
1860, p. 693.

" " = *L. auricula*, Bidrag til Södyr.  
fide Sars, Aftryk af Videnskabs.  
Forhand. i Christiana,  
1860.

\* In individuals of the same size belonging to *H. auricula* there are as many as one hundred saccules in each band; and in *H. octoradiatus* (*Lucernaria octoradiata*, Sars, (non Lamck.) Bidrag til Södyr., 1829, transl. in Oken's *Isis*, 1833, p. 228, taf. X. fig. 6) larger individuals have only "20-30" saccules, in two rows, in each band. By this feature alone the three species may be promptly recognized.

† As I do not possess living specimens of this species, I quote from the descriptions of Sars, as translated in the *Isis*, and Keferstein, and in order that the comparison with the two foregoing species may be as complete as possible, I deem it necessary to give a very full transcript from these authors, supplying from one what the other does not mention. In order that there may be no misapprehension as to the character of Sars's animal, I quote Keferstein in ( ), and any suggestions of my own in [ ].



*Lucernaria octoradiata*, Keferstein, Zeitschrift. Wissenschaft. Zoöl., Siebold und Kölliker, June, 1862, taf. 1, fig. 1, 2, 3, etc., and p. 22 (exclus. synonym., except Sars).

*Lucernaria auricula*, Sars, [non Rathke,] Bidrag til Södyrenes, 1829, translated in Oken's Isis, 1833, p. 228. Taf. X. fig. 6.

“ “ Sars, Fauna Litt. Norveg., 1846, p. 25 (exclus. synonym. Rathke, Montagu, and Lamareck.)

“ The bell is 1" broad,  $\frac{1}{2}$ " high, divided into eight rays; pedicel nearly cylindric, or somewhat rounded four-cornered,  $\frac{1}{2}$ " long,  $\frac{1}{8}$ " thick, ends in a flat disc, in the middle of which is a small round opening," ("basal pore projects into the gelatinous substance as a blind sac"); "four brown red thick stripes in the stem, which prove themselves to be muscles by the movements of the animal," [Keferstein shows that these are the camerae, and that the true muscles are alternate with them; the camerae situated as in *H. salpinx*, and similar in shape and proportions]: "tentacles 40-60, short, thin," ("25-27 tentacles, the knob strictly globular");\* "marginal bodies small, reverted, oblong cylindric, open at both ends, from the outer opening a filiform point can be stretched," [the opening at the outer end is no doubt illusory, as I have pointed out in *H. auricula*, and Keferstein does not speak of it]: "the genital organs extend from the stomach to the end of each ray; 20-30 tolerably large, round or oval, flattened grains" [sacculæ, and, according to his and Keferstein's figures, and specimens sent to me by the latter, in two rows in each band] "fastened to a very thin filiform tube," [this

\* Keferstein's specimens were evidently young, as the number of tentacles shows. The specimens which he sent me are all young.



tube is the narrow muscle which Keferstein describes, along which the saccules are attached]: ("four cylindric or flat bundles of muscular fibres, free in the gelatinous mass,") [according to Keferstein's figure the muscular cords are situated half-way between the centre and surface of the pedicel]: ("the radial muscles of the swimming sac" [oral side of the disc] "occupy the middle line of each arm,") [running from the proximal end of the partitions; as in *H. auricula*, this is, doubtless, merely a more strongly developed margin of the principal muscles which occupy the whole area about the partitions, between the genitals]; ("gelatinous mass" [gelatiniform layer of the aboral side] "a massive layer; it fails in the swimming sac," [oral side]; "in the stem solid between the four tubes,") [as in the two foregoing species]: ("on the surface of the swimming sac [the oral side] heaps of nettling capsules lie in little pockets").\* Geographical distribution: Norway, Sars; St. Vaast la Hogue, north coast of France, Keferstein.†

Art. XIII. — *Monograph of the Genus Callinectes.* — By  
ALBERT ORDWAY.

[Communicated Jan. 7th, 1863.]

[The following paper consists of selections from notes made by Lieut. Ordway during his study of the *Portunidae* with the view of monographing that group of Crus-

\* While the above was in press, I received specimens of this species from Keferstein, and am able, therefore, to confirm what I have quoted from this author.

† I would be glad to receive from the European coast specimens of any of the Lucernarians, and most especially of the following: *Craterolophus Thetys*, *C. convolvulus*, *Depastrum cyathiforme*, *Haliclystus octoradiata*, for which I will send in exchange abundant specimens of our common *Haliclystus auricula*. I will state that I have already sent specimens to Europe *by mail*, in little bottles about an inch and a quarter long, inclosed between two pieces of cork hollowed out. *Henry James-Clark, Harvard University, Cambridge, Massachusetts.*

tacea, a study which was abruptly broken off at the commencement of the present war. This will account for any want of completeness which may appear in the article, and for the absence of figures, which were necessarily left unfinished. The high degree of interest attaching to the discovery of such remarkable differences in the appendages to the male abdomen of forms supposed to be the same by all previous carcinological writers, may serve as an excuse for presenting the paper in its present incomplete form, against the original intentions of its author. — William Stimpson.]

## CALLINECTES HASTATUS Ordway.

*Lupa hastata* Say, Jour. Acad. Nat. Sci. Philad., i. 65.

Carapax in adult specimens about twice as broad as long; anterior portion sparsely granulated, cardiac and branchial regions more finely and densely so; areolations quite distinctly marked, but not so strongly as in *diacanthus*. Teeth of the antero-lateral border conical and pointed, with the sides concave in adult specimens; posterior tooth more than twice as long as the others. Anterior edge of the carapax, that is, the orbit of the eye and the front, finely beaded. Front with two broad, inequilateral, triangular teeth, there being no median teeth present. Sub-median tooth of front rather broad and conical, and well developed. Lower margin of the orbit strongly beaded, in adult individuals with a slight spinous armature at its interior angle. Pterygostomian region densely pubescent in its posterior portion, but towards its anterior portion almost naked; — perhaps the hair is here worn away by the action of the chelipeds. Abdomen of male rather broad; last segment broad and triangular; penultimate segment constricted near the base, with a concave lateral outline. The intro-mittent organs are very long, reaching almost, or quite, to the extremity of the abdomen. They have two curves,

curving first inwards from near the base for over two thirds of their entire length, even so as to touch each other, and then with a strong curve outwards to their termination. Abdomen of the female almost circular in its outline, extremely broad, completely covering the sternum posteriorly, its second segment being but little narrower than the others. Chelipeds rather heavy. Meros with three stout spines on its interior border, and one slightly developed one on its external anterior angle. Carpus with two somewhat granulated ridges, the outer one of which is sometimes produced into a rather obtuse spine. Manus with a stout spine at the point of its upper articulation with the carpus, and a small one near its point of articulation with the dactylus. The carpus of the first three pairs of ambulatory feet have two very small spines on their upper side, one of them, however, being sometimes almost obsolete. The meros joint of the external maxillipeds is sharply truncate at its anterior extremity, and its external angle is rather sharp.

Having had before me hundreds of specimens of this species, I have been able carefully to study all of its variations or departures from the normal form, and some of the changes that it undergoes in its growth. Though in the adult the breadth of the carapax is twice its length, the young are much narrower, — in small specimens, say half an inch long, it is not more than *one and a half* times as broad as long. The teeth of the antero-lateral border, which in the adult are sharp, with concave sides, are in the young broad and conical, with almost convex sides. The chelipeds also increase in length with age. When young, the intromittent organs are also very short, in specimens from one half to one inch in length, not more than two thirds the length of the tail, and almost straight, growing longer and curving as they advance in age. The penultimate segment of the abdomen is not laterally concave, as it

is in the adult. The pterygostomian region appears to be pubescent over its *whole* surface in the young. In the young there also appears to be no development of the internal angle of the lower margin of the orbit into a spine.

The development of the spine on the carpus of the cheliped does not seem to be controlled by growth, but to be wholly irregular.

There are some anomalies not referable to growth, and which we would naturally expect in examining many hundred specimens. Sometimes we find specimens having four spines on the anterior border of the meros of one cheliped, but in no specimen have I seen it on both chelipeds. In one specimen from Hayti there are on the carpus of the left cheliped two spines, the second being at its point of articulation with the manus; another specimen from the same locality has the same thing on the right cheliped. I have seen a few specimens in which, although it could not be said that there was a development of two extra rudimentary teeth on the front, there was yet a slight waviness of the edge, which is rather a persistence of the embryological character than a variation.

Color of living specimen: carapax, and the upper side of the chelipeds and ambulatory feet, olive green. The inside of the chelipeds and sides of ambulatory feet, bright blue. The dactyli of the chelipeds of the female are of a bright red color and tipped with purple; those of the male are of a bright blue tipped with purple.

Range, from Nantucket to Mobile, and perhaps even down to the Brazil coast. Its centre of distribution appears to be Chesapeake Bay.



## CALLINECTES ORNATUS, nov. sp.

Carapax evenly convex, not quite so broad as in *hastatus*, and with the areolations not so distinctly marked as to prevent the carapax from having a smooth, even appearance. The cardiac and intra-medial regions are narrow and elongated. Granulations of the carapax nearly the same as in *hastatus*, except that they are rather more thickly scattered.

Front prominent, four toothed. The outer teeth conical and obtuse, the two inner ones small, almost rudimentary. Sub-median tooth longer and more narrow than in *hastatus*. Teeth of the antero-lateral border very broad, with strongly convex and somewhat granulated sides. The interior angle of the lower margin of the orbit somewhat prolonged into a rounded obtuse tooth. The pterygostomian region is pubescent, although it is quite difficult to determine to what extent, from alcoholic specimens, in which the hair is often worn off. I have, however, a small female in which the whole pterygostomian region is pubescent. The pubescence may decrease with age, being worn off by the rubbing of the chelipeds, or gradually disappearing at successive moultings.

The sternum is quite flat, and its first segment and the episternal pieces of the first segment are different from those of *hastatus*. The abdomen of the male is quite narrow; the penultimate segment has its sides slightly and regularly concave; the antepenultimate segment narrows much more rapidly than in *hastatus*. The intromittent organs are straight and short, reaching to the middle of the penult segment of the abdomen. The abdomen of the female is not so broad as in *hastatus*, only covering the last segment of the sternum, and is much narrower anteriorly, so that it has a more triangular appearance than that of *hastatus*.

The chelipeds are nearly the same as in *hastatus*, and have the same development of spines on the different joints; they are, however, a little longer, and the lamelliform projection on the trochanter that laps over the coxal joint is smaller and more rounded. There is only one spine on the carpus of the ambulatory feet, with numerous little spiniform projections; on the third pair only the small spiniform projections appear to be present.

This species is easily recognized, and can in no way be confounded with *hastatus*. The great difference in the intromittent organs, the very narrow and almost straight abdomen of the male, with the striking narrowness of the cardiac and intra-medial regions of the carapax, enable us to distinguish this species without difficulty.

It is lightly and brightly colored, and extremely different in that respect from *hastatus*. But I have only an imperfectly colored drawing, from which I would not attempt a description of the colors.

I have not had before me such an immense mass of specimens of this species as of *hastatus*, and of course have not been so well able to trace the growth and variation of the species.

A small specimen from Texas, apparently belonging to this species, has the posterior tooth of the antero-lateral border perfectly straight, without curving at all forwards as it generally does. It also has a faint trace of a development of two extra spines on the carpus of the chelipeds.

I have seen but one female of this species, and in that the carapax is much more convex than in any of the males. Out of nearly one hundred specimens of this species from Tortugas, there was not a single female.

Its geographical distribution is different from that of *hastatus*, being much more southern. Specimens in the Museum of Comparative Zoology are from Cumana, Capt. Couthouy; Hayti, A. Hilchenbach; Bahamas, Dr.

Bryant; and Tortugas, Dr. Holder. It has also been found in Charleston Harbor, by Prof. Agassiz. It is about two thirds the size of *hastatus*.

## CALLINECTES LARVATUS, nov. sp.

Carapax quite narrow, strongly convex, and very uneven — the areolations being very strongly marked. It is granulated in the same way as *ornatus*, though rather more coarsely. The teeth of the front resemble those of *ornatus*, but are more developed and obtuse. Sub-median tooth of front long and narrow. The teeth of the antero-lateral border are long, quite obtuse, separated from each other at their base, and even curved slightly forward. Interior angle of the lower margin of the orbit prolonged upwards into a very prominent tooth, as large as those of the lateral border and very obtuse. Pterygostomian region pubescent. Sternum quite narrow, and slightly convex. Abdomen of the male very similar to that of *ornatus*, but the intromittent organs are very different, being very short and curved, scarcely reaching beyond the base of the penult segment of the abdomen. The abdomen of the female is rather narrow. Chelipeds slightly longer than in *ornatus*. Manus with the costæ very prominent. Carpus quite rough, with three distinct ridges, and scattered granulations; armed with one spine, and with the rudiments of two others generally distinctly visible and even sometimes developed. Meros and manus with the same number of spines as in *ornatus*. The lamelliform projection of the trochanter is broad and square.

This species is most nearly allied to *ornatus*, but can easily be distinguished from it. The striking differences in the intromittent organ and carapax are fully sufficient to enable us to recognize it.

One specimen of this species has *five* spines on the meros joint of *one* cheliped, and two others have four.

Its size is about that of *ornatus*. Found at Key West, Florida, J. E. Mills; at the Tortugas, J. E. Mills; at the Bahama Is., Dr. Bryant; and at Hayti, Dr. Weinland.

CALLINECTES TUMIDUS, nov. sp.

Carapax quite convex, broad, and roughly granulated, with the areolations quite distinctly marked. Antero-lateral border much more arcuated than in any of the preceding species, and provided with very broad and large teeth curving slightly forwards, with convex sides. Posterior tooth very slightly prolonged, differing in this respect from any other species of the genus that we now know. Front armed with four obtuse, sub-equal teeth. Interior angle of the lower margin of the orbit developed into a rounded and somewhat prominent tooth. Sternum flat; in the only adult male specimen that I have, it is even slightly concave. Abdomen of the male slightly broader than in *ornatus* and *larvatus*, penultimate segment quite short, and with a slightly concave lateral outline. The intromittent organs reach to the middle of the penult segment of the abdomen, are curved, and very distinctly hooked at their ends.

The chelipeds are quite stout, and the granulations on the costæ of the manus very coarse. The carpus has roughly granulated ridges, as in the preceding species, but in none of my specimens is it armed with any spines, only faint traces of them being visible; but on its interior border we observe two little prominences, one at the internal angle, the other just below it. Meros armed with three spines on the anterior border, but only faint traces of one at the external angle.

I have examined only a few specimens of this species, but fully sufficient to show that it is distinct from any other. The convex carapax, with its semicircular antero-lateral border, short posterior tooth, and the hooked intro-



mittent organs, are very striking characteristics. It is nearly as large as *hastatus*.

Found at Key West, Florida, by J. E. Mills, and at the Island of Hayti, by A. Hilchenbach.

There is a small specimen of a sterile female from Aspinwall in the museum of the Smithsonian Institution, which apparently belongs to a different species from any of those that I have described. The carapax is quite broad and convex, and in its general features very much resembles that of *tumidus*. But the hepatic region is smooth—wholly destitute of granulation. The front is armed with four teeth which are almost equal in size. The teeth of the antero-lateral border are very broad, with convex sides, and with their bases in close contact. Sternum slightly convex. Chelipeds not quite so stout as in *tumidus*.

CALLINECTES DIACANTHUS Ordway.

*Lupa dicantha* Dana, U. S. Expl. Exped., Crust. i. 272.

Through the liberality of the Smithsonian Institution, I have been able to examine the specimen described by Dana, from Rio Janeiro. As it is only a single dried specimen, it is rather difficult to make a thorough comparison, but I have not the least doubt that it is entirely distinct from any of the more northern species. It is the most closely allied to *ornatus*. But the carapax is more convex, the branchial regions more swollen, and the cardiac and intra-medial regions do not exhibit the narrow form characteristic of *ornatus*; in fact, the carapax bears more resemblance to that of *larvatus*. The teeth of the front resemble those of *ornatus*, but they are comparatively quite sharp. Sub-median tooth of front quite slender. Spine on the interior angle of the lower margin of the orbit comparatively sharp. The teeth of the antero-lateral border are very nearly of the same size and shape as in *ornatus*, but are rather more separated at their bases.

The sternum is quite flat, more so than in *ornatus*. Abdomen of male slightly broader than in *ornatus*, and penultimate segment considerably broader at its base, giving a somewhat different outline to the lower part of the tail. The intromittent organs are quite characteristic, being long and straight, reaching beyond the middle of the penult segment of the abdomen, but not to its extremity; and their tips are slightly turned outwards. The meros joint of the chelipeds is armed with three spines, but they are not so close together as in *ornatus*, and the spine at the base of the manus is much longer and curved. It is somewhat smaller than the *hastatus*.

CALLINECTES TOXOTES, nov. sp.

Carapax quite broad and rather convex, rather sparsely granulated, the areolations quite distinctly marked, the cardiac region distinctly divided into two lobes by a furrow down its middle and a prominence on each side. Intra-medial region rather long and narrow. Front armed with four sub-equal, obtuse teeth. Sub-median tooth of front slender and obtuse. Pterygostomian region as in the preceding species. Sternum quite flat. The abdomen of the male is very broad, and bears a very close resemblance to that of *hastatus*, except that the antepenultimate segment is not quite so much constricted at its base. The intromittent organs are also very long, reaching almost to the end of the tail; but instead of curving inwardly, as in *hastatus*, for two thirds of their length they curve outwardly, and the ends make an almost circular curve, so that their tips are brought together. I have not seen a female.

The chelipeds are quite stout. The granulations on the costæ of the manus and carpus are quite coarse. The number of spines on the joints of the chelipeds is the same as in *hastatus*. The three spines on the meros are long and slender, and quite remote from each other.

This species is entirely distinct from any of those of the eastern coast of North America. In the abdomen of the male and its intromittent organs, it bears a resemblance to the *hastatus*, but is easily distinguished from that species by the different curvature of those organs and the flatness of the abdomen, as well as in the characters of the front, which has four equal teeth. The narrowness of the cardiac and intra-medial region, and the lobation of the former, are also quite characteristic.

Locality, Cape St. Lucas. Collected by John Xantus, Esq. Museum of the Smithsonian Institution.

It is one of the largest species known, equalling even the *hastatus* in size.

CALLINECTES BELLICOSUS Ordway.

*Lupa bellicosa*, (Sloat MS.) Stimpson, Notes on North American Crustacea, p. 11.

The carapax is quite smooth and evenly convex, the areolations not being prominent, and the granulation quite fine. The front has two outer slender and sharp teeth, with the faint traces of two median ones. The teeth of the antero-lateral border are rather broad and sharp, with somewhat concave sides. The sternum is rather flat and broad, and has scattered punctures on its surface. The abdomen of the male is broad, broader even than in *hastatus*; its penultimate segment is not narrowed near its base, as in that species, but has a broad base, and is contracted near the centre. The meros of the chelipeds, in the only specimen that I have seen, has four spines on the anterior border. There are two small spines on the carpus, one at the outer border, the other at its point of articulation with the manus, with a slight rudiment of one between them. There is one very prominent granulated ridge on the carpus, and two or three granulated tubercles. One quite prominent spine on the carpus of the first three

pairs of ambulatory feet. The intromittent organs reach a little beyond the middle of the penult segment of the abdomen; they curve outwards strongly near their extremities, and then inward to their tips, which again point a little outward. About the size of the *ornatus*.

Pinicate Bay, Gulf of California. Museum of the Smithsonian Institution.

CALLINECTES ARCUATUS, nov. sp.

I have but one specimen of this species, and it is very closely allied to the *diacanthus*. The carapax, however, is more evenly convex, and finely granulated, and the anterolateral borders are quite semicircular. The sternum is not so flat as in *diacanthus*. The abdomen of the male is much broader than in *diacanthus*, being nearly as broad as in *hastatus*, but the penult joint exhibits no constriction near the base, being, on the contrary, wider at the base than anteriorly. The intromittent organs exhibit a striking resemblance to those of *diacanthus*, being more alike than any other of the known species of the genus. Almost the only difference that can be observed is, that they are, perhaps, more slender in this species.

The chelipeds are slightly shorter than in *diacanthus*, and the costæ of the manus and carpus are very sharply defined and closely granulated. The three spines on the meros are more slender and closer together, and what is quite remarkable, there are three sharp and equal spines on the carpus. It is of about the same size as the *ornatus*.

Cape St. Lucas, John Xantus. Museum of the Smithsonian Institution.

CALLINECTES PLEURITICUS, nov. sp.

This species in some of its characters closely resembles *larvatus*, while in others it is allied to *arcuatus* and *diacanthus*, but nevertheless it is distinct from any of them. In



the characters of the carapax it resembles *larvatus*, but the carapax is more evenly convex, and the areolations are not so swollen, nor the granulations so coarse. The teeth of the front are less prominent. The antero-lateral border is rather more circular, and its teeth quite different from those of *larvatus*, being broad, convex, and close together. The sternum, instead of being narrow and somewhat convex as in *larvatus*, is broad and flat as in *arcuatus*. The abdomen of the male bears most resemblance to that of *larvatus*, while the intromittent organs closely resemble those of *arcuatus*, and are very different from those of *larvatus*. They are long, slender, and straight, as in *arcuatus*, though they differ in being slightly longer and less bent at their tips.

The spines on the meros joint of the chelipeds are not so close together as in *arcuatus*, and the spine at the base of the manus is much longer and curved.

This species is a small one, our largest specimen being less than half the size of *hastatus*.

Found at Panama by Alex. Agassiz, Esq.

#### REMARKS.

The scanty materials that most authors have possessed have prevented them from arriving at any definite and correct idea of the species of *Callinectes*, and very great confusion has arisen on the subject. Many authors have thought that there is but one species on the eastern coast, and even those of the western coast have been considered identical with it. Consequently the descriptions in the few cases in which descriptions are given, are such that it is impossible to tell to what species they allude, and evidently in many instances the writers have had several before them. Such being the confusion, it is difficult to determine the synonymy of the different species with accuracy, so that I have reserved my opinions on that point for separate consideration.

Bosc is probably the first one who speaks of any species of *Callinectes*. Unfortunately, however, he speaks of it under the name of *Cancer hastatus* Fabr., (which is probably the *Acheloüs spinimanus* Stm.) and translates Fabricius' description of that species into French, instead of describing his own specimens. I think that no one can doubt that Bosc really had before him specimens belonging to the genus *Callinectes*, and probably to *C. hastatus*. For he speaks of them as being daily used in Charleston for food, and as caught in great numbers, and describes the method of catching them. No other Portunid is so caught and used there.

Latreille, in the "Encyclopédie Méthodique," was the next author who described any species of *Callinectes*. But his description is so indefinite and confused, that I have found much difficulty in unravelling it. Under the name of *Portunus diacanthus*, he evidently includes several species, one of which was from Brazil, described by Marcgrave — I cannot say to what genus this belongs. He says, also, "Quelquefois, comme dans deux individus envoyés de Philadelphia par M. Milbert, les quatre dents du front sont réunies et ne forment qu'un lobe largement échancré." Here he evidently speaks of the *C. hastatus*, which is the only species that occurs at Philadelphia. In the preceding paragraph he speaks of the carapax as being of an obscure greenish anteriorly, and in his Latin diagnosis as being yellowish, maculated with red, which contradiction is somewhat puzzling. We might at first be inclined to reject the name *diacanthus*, as it seems impossible to affix it to any one species, except arbitrarily. But in such cases as this we must always endeavor to ascertain an author's intention, and I think that I have done that. Under the name of *Portunus pelagicus* he previously describes the *Neptunus pelagicus* from the East Indies, remarking that it is the *pelagicus* of Fabricius, but not of

De Geer and Bosc. The *pelagicus* described by these two latter authors, and by Say, (which latter is the *Lupa Sayi* of Gibbes,) he puts as synonymes of his *P. diacanthus*. I think it is perfectly evident that his intention was to change the name *pelagicus*, as being preoccupied by Fabricius for another species, and that his name *P. diacanthus* must therefore apply to the *pelagicus* of Bosc, De Geer, and Say, which, as is well known, belongs to the genus *Neptunus*. It does not alter the case, that Latreille in his description mixed up several species, and evidently included the *C. hastatus*.

Milne-Edwards following Latreille, describes one or more species under the name of *Lupa dicantha*, but it is impossible to say to which of our species his description applies, as he gives no character by which one can recognize it. Nor are we aided any by the synonymes which he quotes. He quotes the "Crabe de l'Océan" of De Geer, the *P. pelagicus* of Bosc, and the *P. diacanthus* of Latr., (which, as I have shown, are synonymous with the *L. pelagica* of Say;) the *Portunus hastatus* of Fabr., which is probably the *Achelous spinimanus*; and finally the *Lupa hastata* of Say.

Subsequent authors have mentioned our species of *Callinectes* without critically examining the work of their predecessors, and have spoken almost indiscriminately of *L. diacantha* and *L. hastata* — often regarding them as synonymous. Gibbes, in his Catalogue of the Carcinological Collections of the United States, speaks of only one species as inhabiting our coast, though he evidently noticed some differences, as he says, "In the specimens from Charleston harbor and northwards, the middle spines of the front are obsolete, but distinct in those from Key West."

Dana in his "Crustacea of the United States Exploring Expedition," describes a species of *Callinectes* from Rio



Janeiro, which, as we have shown, is distinct from any of those of the United States coast. Dana, however, makes it synonymous with the *L. dicantha* of Milne-Edwards, and *Portunus diacanthus* of Latr. But the *P. diacanthus*, as I have already shown, is a *Neptunus*. I retain the name *diacanthus* for the Brazilian species, though it is probably not the *dicantha* of Milne-Edwards.

De Saussure, in his "Crust. de la Mexique," etc., confounds all of the species of *Callinectes* of the eastern coast together, though he thought that there was a great variation in them. He mentions in particular a female from Cuba with a very convex carapax, and the teeth of the front equal, which may be our *C. tumidus*. He calls them all *L. diacantha*.

Stimpson, in his "Notes on North American Crustacea, No. 1," mentions, under the name of *L. bellicosa*, the first *Callinectes*, in fact the first Portunid, discovered on the western coast.

In his second number he institutes with good reason the genus *Callinectes*. But unfortunately, from want of sufficient material, he does not correct the errors of previous authors, but expresses himself as "unable to find constant differences between the northern and southern varieties of this species," and also regards the species of the western coast as identical with it.

Our materials have been large, and we have spent much time in investigating them, being actuated solely by a desire to arrive at the truth, and we think that all of the species that we have indicated are truly distinct. The characters which separate them do not vary, and there is no gradual passage from one species to another. Differences in organs of such importance as those of generation, and so marked as those we have pointed out, are certainly reliable.

All species of *Callinectes* exhibit a singular resemblance



in some characters, while they are widely different in others. Thus the external maxillipeds, the chelipeds, the pterygostomian region, the posterior tooth of the antero-lateral border, in all except *tumidus*, are very much alike. The shape of the abdomen in both the male and female, is quite characteristic of the species, in this genus.

The materials upon which the above observations were made are in the Museum of Comparative Zoölogy at Cambridge and that of the Smithsonian Institution at Washington.

ART. XIV.— *On the Fossil Crab of Gay Head.*— By  
DR. WILLIAM STIMPSON.

[Communicated January 21, 1863.]

THE occurrence of remains of Crustacea in the green-sand layer of the interesting series of strata exposed at Gay Head, the southwestern extremity of Martha's Vineyard, has long been known. Dr. Hitchcock alludes to them in the first edition of his "Geology of Massachusetts," published in 1833, as well as in the second edition of the same work (1841). They are there described in the following terms, which we give entire, as showing the *lithological* character of the specimens:—

"*Crustacea.* In the green sand at Gay Head, we meet with well-characterized specimens of the genus *Cancer*, although they are in general much broken; showing that they originally belonged to a formation which was abraded or destroyed anterior to the production of the green sand. The interior part of the specimen consisted of argillaceous matter, probably containing a large proportion of oxide of iron; but the covering of the animal still retains its black shining color, although apparently carbonaceous. The broken state of nearly all the specimens, renders it difficult to determine whether they belonged to more than one spe-

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cies, although they probably did; and for the same reason I have thought that drawings would not be of use."

In the summer of 1859 a large number of specimens of these fossil crabs were collected by Mr. Ordway\* and myself, and in 1862 collections were made at the locality by Messrs. Hyatt and Shaler, which include some of the best examples yet found. These materials, though abundant, consist for the most part of small fragments; and there are none which are sufficiently well-preserved to give a proper idea of the entire crab. By the study and comparison of these fragments, however, I have been able to refer them all to two species, both brachyuran. Only one of them is sufficiently well represented by specimens to enable me to judge of its perfect form and true place in the system. To this species nine tenths of the fragments belong, and by the combination of these, I have endeavored to reproduce the essential parts of the crab, and to represent them in the accompanying diagrams.

I cannot refer the species to any described genus, either recent or fossil; but there is abundant evidence that it belongs to the *Carcinoplacidae* of Milne-Edwards,† of which family it forms a new genus and species. It may be called

ARCHAEOPLAX SIGNIFERA.

Pl. XII., figs. 1-4.

The *carapax* is remarkable for its great posterior breadth. This is, indeed, characteristic of the family *Carcinoplacidae*, which are consequently placed in the great group *Ocypodoidea*, notwithstanding that the conformation of their maxillipeds and sternum resembles closely that found in Cancroids. The approximate length of the carapax (Pl. XII., fig. 1.) in the best specimen is 1.6 of an inch; its greatest breadth is 2 in., and the breadth at the posterior

\* The instructive specimens in the Museum of Comparative Zoölogy, developed by this gentleman, have aided me much.

† *Mélanges Carcinologiques*, p. 128.

1.5. It is much curved, in a longitudinal sense, so that the superior outline in a side view forms the arc of a circle, the middle height of which would be nearly half an inch. It must be here stated that the diagram, (Plate XII., fig. 1,) represents the crab turned up into such a position as best to show the anterior portion, while the posterior portion is foreshortened. In a transverse sense, the carapax is but slightly convex anteriorly; posteriorly the median or greater part is nearly flat, but there is on either side a well-defined longitudinal channel or concave depression, where the branchial region slopes abruptly toward the postero-lateral margin. The surface is smooth and covered with minute punctures, except anteriorly and at the margins, where it becomes distinctly granulated. The central region is defined by two lunate marks, which, though not projecting above the general surface, are conspicuous by their smoothness and darker color, and serve as a sign by which some fragments of the carapax of this crab may always be recognized.

The *antero-lateral margin* is armed with four teeth, the first or anterior one forming the outer angle of the orbit. The second and fourth teeth are about equal, and scarcely more distant from each other than the first and second, while the third is very small, as if supplementary and intercalated between its neighbors. The *orbits* are elongated, each occupying nearly one third the width of the carapax, and have an entire, though granulated superior margin. As far as can be discovered in the specimens at hand, there is no notch between the front and the orbit, at the attachment of the external antennæ, for the inner angle of the orbit forms, apparently, the outer angle of the front. The *front* occupies about one fourth the breadth of the facial region, and has a small projecting lobe at the middle, which is divided in two by a median emargination.

The *chelipeds* are of moderate size, and resemble in gen-



eral form those of the *Cancridae*. They are almost exactly similar to those of *Pseudorhombila* as figured by Milne-Edwards,\* but are somewhat shorter. The carpus is nearly quadrangular, a little uneven on the upper surface, and armed with a strong tooth at the inner angle. The hands are smooth and unarmed, with fingers not longer than the palm, and somewhat tuberculated toward their extremities. Of the *ambulatory feet* we have few and very imperfect indications. It can only be said, that they appear to be smooth, without teeth or spines; and that the thighs or meros-joints are of great breadth, though not particularly compressed.

Of the *outer maxillipeds*, (Pl. XII., fig. 2,) I find reliable specimens only of the ischium-joint of the endognath, and of the first joint of the exognath. The latter is remarkable for its very considerable breadth, being more than half as broad as the ischium of the endognath. This ischium is a little more than one half longer than broad, marked with scattered shallow pits and with the usual longitudinal sulcus, and ornamented along its inner margin with crowded and minute punctures for the attachment of bristles, with which this margin was in life densely clothed. Of the meros of these maxillipeds I find only small and doubtful fragments, which, however, seem to indicate a strong prominence of the external angle of this joint,—stronger in fact than I have ventured to represent in the diagram.

The *sternum* (Pl. XII., fig. 3), is quite well preserved, except as regards its posterior extremity, in several specimens, which have all belonged to male individuals. It is rather broadly expanded anteriorly, and very little convex, even in a longitudinal sense. Its anterior triangular projection is separated by a slight transverse sulcus, and there are, in some examples, slight indications of a transverse sulcus posterior to this, arising from the next notches of the margin, and bending backward. At the posterior margin of the second

\* Arch. du Muséum, T. VII., Pl. xi. f. 4.



segment on each side, where it passes beneath the abdomen, we find the genital tubercle, as represented in fig. 4. These tubercles have thus the same situation as in Portunids, while in the crabs most nearly allied to that here described, it is more frequently found near the anterior margin of the segment. The last or posterior segment of the sternum does not project laterally beyond the margin of the male abdomen, as is usual in Ocypodoids, but is much narrower than the preceding segment, and entirely concealed, as in Cancroids.

The *abdomen* of the male only has occurred (Pl. XII, fig. 3). It is quite broad for a male abdomen, and its middle three segments are not soldered together, but distinct. I have seen no specimens in which its basal joints are well preserved, but they cannot differ much from the representation given of them in the diagram.

The male organs, or *verges*, in this genus arise directly from the coxal joints of the posterior feet, and not from the sternum. The posterior segment of the sternum is not distinctly grooved for their passage to the intromittent organs, although there is a slight depression; but this is very little deeper than in *Carcinus*, with which genus ours shows much resemblance in the structure of this part of the body.

As illustrations of this fossil crab, I have given my working diagrams, instead of figures drawn from nature; for to represent all the parts in the diagrams by the latter method, the delineation of an inconveniently large number of specimens would be required.

It will be seen from the foregoing description that *Archaeoplax signifera* presents, in its different parts, the characters of widely-removed groups of Brachyura. This indeed is the case with most of the genera of the family *Carcinoplacidae*, in which I have placed it. In its carapax and elongated orbits we find most resemblance to Ocypodoids, for though certain Cancroids, like *Trapezia*, have a quadri-

lateral carapax, this character is not in them accompanied by the form of orbit alluded to, which indicates considerable length in the ocular peduncles. In the outer maxillipeds, and in the shape and anterior breadth of the sternum, we have an unmistakable resemblance to the *Portunidae*; but in the seven-jointed male abdomen we find a return to the Ocypodoid character, for that part of the body in all male Portunids is five-jointed.

With regard to the more intimate relations of *Archaeoplax*, it may be remarked that while the shape of the carapax and its postero-lateral depressions or channels are the same as in the *Carcinoplacidae*, the orbits and antero-lateral margins more closely resemble those of *Prionoplax*, a genus of *Gonoplacidae*. But our genus is removed from the latter family by the form of the posterior segment of the sternum, which is not "*debordant*" or exposed on either side beyond the abdomen, this being, in *Gonoplacidae*, narrow at the base. From the genera of *Carcinoplacidae* already known, the new fossil genus differs as follows:— From *Eucrate*,\* which it exactly resembles in the shape of the front, it differs in its elongated orbits, and broader male abdomen. From *Pseudorhombila*,— to which I have already alluded as having similar chelipeds,— in the form of the orbits and antero-lateral margin. From *Carcinoplax* and *Pilumnoplax*, it also differs in the character of the orbits. Finally,

\* Professor Dana has misapprehended the genus *Eucrate* of De Haan, in placing it in the *Gonoplacidae*, having been very naturally misled by that author's neglect to give the position of the genital appendages of the male, a point of the highest importance. The resemblance to the *Gonoplacidae* in De Haan's genus, is indeed great; but I have recently had occasion to examine, in the Museum of Comparative Zoölogy, wet specimens of *Eucrate crenatus*, the typical, and indeed the only species yet known, in which I find that the male organs arise from the coxæ of the posterior feet, and are not "*e sterno ortæ abdominisque tectæ*," as given in Dana's diagnosis of the genus (Crustacea of the U. S. Exploring Expedition, I. p. 310). The crab, therefore, will fall into the *Carcinoplacidae*. The *Eucrate crassimanus* of Dana, having sternal verges, is, therefore, not a true *Eucrate*, but will be the type of a new genus, upon which I will not here impose a name, but merely point it out for the benefit of whomsoever may hereafter monograph the group.

from *Heteroplax* Stm., (Prodr. descr. anim. evert. etc., p. 40,) to which, of all existing Crustacea, our fossil genus approaches nearest, it is removed by the presence of a median frontal emargination, and also, if I have rightly interpreted the scanty material at hand for this point, in the want of the antennary notch which separates the front from the inner angle of the orbit.

No fossil crab, to which *Archaeoplax* has any close relations has yet been described, with the exception of *Arges* of De Haan, (Fauna Japonica, Crust., p. 62, Pl. v., f. 4,) which differs from our genus in its shorter carapax, unarmed antero-lateral margin, and narrower exognath of the outer maxillipeds. Nothing is known with regard to the formation in which *Arges* occurs.

The study of the *Archaeoplax*, as an isolated fact, affords but little aid in the determination of the age of the Gay Head deposit. It belongs to one of the highest grades of Crustacea, but still higher forms have been found in the Eocene Tertiary, for instance *Xanthopsis* of McCoy in the London clay. I was probably wrong in referring the green-sand layer to the Cretaceous in the Am. Journal of Science for January, 1860, although Dr. Hitchcock suggests that this layer may consist of the *débris* of some older deposit, such as the Cretaceous; but there is nothing to confirm this view in the character of the fossils accompanying the crabs.

The abundance of specimens of the *Archaeoplax* at Gay Head, indicates a warm climate in that region at the time they were living. At the present day all *Carcinoplacidae* are inhabitants of warm seas. The nearest allied genus, *Heteroplax*, lives on the coast of China at the northern limit of the torrid zone.



ART. XV. — *On Synthetic Types in Insects.* — By  
A. S. PACKARD, JR.

[Communicated March 4, 1863.]

WHILE studying the Hepiali with reference to their standing and connection with the main body of the family of Bombyces, and striving to overcome difficulties that arose as to the importance of certain structural features, which, taken in connection with their habits, render their location in this family very difficult, I was throughout struck with the great resemblance of the genus *Gorgopis* of Hübner to the neuropterous genus *Polystæchotes*, and made a detailed comparison of the two which is given below. The close resemblance of many small Phryganeids to the small moths with long antennæ, is familiar to every entomologist, and has caused the Lepidoptera to be placed by some writers very near to the Neuroptera, though in fact these groups are very widely separated; and it was only by confounding mere transient analogies of outer form with that more fundamental likeness of the young and adult stages of two beings to each other, whereby we are enabled to arrange them in some sort of series, that the error was made.

Some remarks in this connection on the well-known analogous forms existing in the different sub-orders of insects, will serve as an introduction to more special observations on those stronger analogies which we find in nearly every family of the Neuroptera to every other sub-order of insects.

If we consider the Hymenoptera, Lepidoptera, and Diptera by themselves, in the order in which Latreille has placed them, we shall find these three groups full of reciprocal analogies. Certain forms in the one sub-order leap over their neighboring sub-order to find their analogues in one

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a third removed : or again, we see analogous forms between the two higher groups, leaving the lowest for a while isolated ; or on the other hand the two lower groups are thus united, leaving the highest one standing by itself. For example, the clear-winged *Sesia* imitates the humble-bee in its form and flight ; the different species of *Ægerians* simulate members of nearly every hymenopterous family, as we can see when recalling such names as *apiformis*, *vespiformis*, *philanthiformis*, *tiphiæformis*, *scoliæformis*, *spheciformis*, *chrysidiformis*, *cynipidiformis*, *formiciformis*, *ichneumoniformis*, *uroceriformis*, and *tenthrediniformis*. So also other *Ægerians* resemble different family forms of *Diptera*, as seen in the names *culiciformis*, *tipuliformis*, *biblioformis*, *anthraciformis*, *muscæformis*, &c. In the *Diptera* we find *Bombylius*, resembling, as its name implies, *Bombus* ; and also *Laphria*, which so closely apes the humble-bee in its form, coloration, size, and flight, even to the buzz, which is, if anything, still louder. Also there is the strongest resemblance in some *Syrphi* to *Vespa*, and especially to different species of *Crabro*. But while the *Lepidoptera* and *Diptera* resemble the *Hymenoptera*, we cannot say that *Hymenoptera* ever assume the form of any flies and moths. They seem isolated ; and resemble only themselves. In the case of the *Laphria*, the plump, bee-like form, and the dense yellow and black hirsuties, which cause them to be mistaken for humble-bees by persons unacquainted with their structural differences, are just those features that are exceptional in the *Diptera*, and are normal in the *Hymenoptera*. The fly to get them has to pass over one sub-order to obtain a bizarre form which is a prevalent and common family attribute of the *Apidæ*.

There is a similar parallelism of analogous forms between the *Coleoptera*, *Hemiptera*, *Orthoptera*, and *Neuroptera*, which seem bound together by affinities such as those

that unite by themselves the bees, moths, and flies. Thus there are certain Hemiptera (*Corixa*) that resemble the coleopterous genus *Brachys*; *Forficula* is analogous to the Staphylinidæ, and *Blatta* may be said to resemble some Lampyridæ. The close affinities between the Orthoptera and Neuroptera hardly admit of these analogous forms, though we find them still. Here again we see the isolation of the Coleoptera from the other sub-orders with which it is connected. The sub-orders below it, by an exact parallel with the case above mentioned, reach up and connect themselves by these remarkable analogies with the Coleoptera, which do not in turn assume any of their forms. Some Orthoptera are very coleopterous-like, and some Hemiptera are very coleopterous-like. The reverse cannot be said. So the Diptera and Lepidoptera, as they advance in their family forms, are constantly throwing out hints and suggestions of forms that seem very strange to them, but become generalized in the group that tops them. Thus in the broad, irregularly net-veined, neuropterous fore-wing, which becomes smaller and thicker in the orthopterous *Blatta*, and still more coleopterous in the hemipterous *Corixa*, we arrive at the perfected elytron, with its regular, obsolete veins, and new protective function.

Most of the examples above mentioned are familiar to entomologists, and others will occur no doubt to illustrate the subject more fully.

Many authors have agreed that the sub-orders of insects can be arranged into two series or groups, often called Mandibulata and Haustellata, though disagreeing as to the relative rank of these two divisions, and the true places the sub-orders should occupy within them. It is enough for my purpose to assume that there are two such series, though believing that the two culminate in the Hymenoptera and Coleoptera respectively, in the succession that I have indicated above.

What have we now in common with both, and which shall reunite this seeming polarity in the two series of sub-orders? There is needed a group which, while retaining its own strong fundamental features, and maintaining an equal footing with its equivalent groups, shall have besides the strongest analogies to those groups farthest removed by affinity, in order that these two series may be virtually brought together; while the successive forms in the several families shall afford us some conception of the larger categories these minor groups foreshadow. Such a group Professor Agassiz\* has pointed out in the class of Selachians, which combine the characters of all the other classes of fishes existing during the same period, and also, by their being the earliest in time, afford what he calls *prophetic types* of all the coming classes of vertebrates. The former case affords what he calls *synthetic types*.

In endeavoring to show that a similar Synthesis among insects has its seat in the Neuroptera, I would in the first place instance the genus *Lepisma*, one of the Thysanoura which Burmeister places among the Orthoptera, and which also reminds us of the larvæ of *Perla* and *Ephemera*. In the scales which clothe the body of *Lepisma* we are reminded of the squamation of the Lepidoptera; but we mention this group now, in order to point out some strong analogies they bear to the chilopodous Myriapods. This is seen in their elongated, flattened form, which is due to the uniformity in the size of the rings of the three divisions of the body, by which the distinctions of the head, thorax, and abdomen seem almost annulled; and in the fact that while *Lepisma* does not differ greatly in size from the small genus *Scolopendrella*, it agrees also in the semi-oval head, in the anal stylets, so unusual in the Myriapoda, and especially in the two pairs of little, move-

\* Essay on Classification.



able stylets, which are removed towards the base of the abdomen more than usual, to support the long, weak abdomen, reminding us of the abdominal legs of Myriapods, while the two terminal longer pairs project out horizontally.

In the two families *Ephemeridæ* and *Libellulidæ* no instances of these analogous forms occur to us. They are the most unlike other insects.

*Ascalaphus*, one of the *Myrmeleonidæ*, was described by Scopoli as a *Papilio*, and has been said by Kirby to resemble *Heliconia*. Indeed, if we consider the remarkable departure of this genus from others of its family, the mistake will seem almost pardonable. In the long abruptly clubbed antennæ, and the long hirsute mouth parts that project between them and look like the palpi of butterflies; in the round, globose, prominent eyes which are much like a butterfly's; also in the short, cylindrical, oval thorax, and short ovate abdomen, which is much the broadest in the middle, we see that concentration of the rings into the three regions of the body which obtains so fully in *Papilio*, and is so different from *Myrmeleon*. We shall by closer observation see that the enlarged oval thorax is made so by the greatly diminished size of the pro-thorax; and in the enlarged, convex scutum of the meso-thorax, and the contracted basal joint of the abdomen, compensated by the swollen middle rings, we have a form that the highest *Lepidoptera* possess. Moreover in the broad wings, the gay colors, and enjoyment of the hot sun, the tropical *Ascalaphus* resembles the narrow, transparent-winged tropical *Heliconidæ*.

The name of *Mantispa* recalls the orthopterous family *Mantidæ*, whose linear bodies, long legs, and small wings find analogies in the rapacious neuropterous genus.

The family *Panorpidæ* assumes dipterous shapes. *Bittacus* has its analogue in the fly *Bittacomorpha*. The



resemblance of the female *Panorpa* to *Tipula* is very striking. In both the mouth parts are greatly elongated, and the head much produced in that direction, leaving a very short vertex ; and the antennæ are much the same in size and shape. *Panorpa* is remarkable for the short, ovate, compressed thorax, owing to the reduced size of the prothorax, and the compactly massed notal and side pieces, wherein it simulates *Tipula* ; but the resemblance is still greater in the elongated episterna and coxæ, and the long slender legs. If we go more carefully into a comparison of the notum of both insects, we shall find the large meso-scutum, the short scutellum, and the longer than broad horse-shoe-shaped scutum of the meta-thorax of *Panorpa* closely resembling those pieces in *Tipula*. There is the same form of the first pair of wings. In both the straight costa bends gradually around at the apex, as the inner edge curves up just as rapidly to meet the costa at the apex which is situated in the middle line of the wing. Also in the disposition of the main nervures, their relative distances apart, and their termination, even to the formation of the pterostigma and the branches that lead to and from it, the analogy is still maintained. At the base of the wing, and towards the outer margin of *Tipula* there are a few cross recurrent nervules, and irregularities in the branching of the principal nervures that remind us of the system of net-veins that cross the wings of *Panorpa*. The abdomen in the two genera is dilated at its base and appressed to the thorax ; and in its long, cylindrical form it bears a similar proportion to the head and thorax, while the swelled extremity and genital pieces in the females of both genera are strictly analogous. Both genera agree, according to the representations of authors, in supporting themselves on their long legs, while introducing their slender and pointed abdomen into the earth, when about to deposit their eggs.

The *Hepialus argenteomaculatus* of Harris, which is figured in Professor Agassiz's work on Lake Superior, is the type of a number of gigantic moths belonging to Hübner's genus *Gorgopis*, in which, in the elongated body, the large, broad, equal wings, and the details of their structure, we find a very unexpected analogue to *Polystæchotes*, which is also a gigantic member of the family *Hemero-biadaæ*, of which the lace-winged fly, *Chrysopa*, is an example. One of the most constant family characters in the Lepidoptera lies in the relative size of the three pieces that form respectively the base, the vertex, and the front of the head, that are called by authors occiput, epicranium, and clypeus. The Bombyces are characterized by the reduced size of the two first-named pieces, and the enlarged area the shield-shaped clypeus presents, which forces the antennæ back upon the vertex, and leaves the upright vertical front broad and open. Now in the Hepiali there is the greatest equality in these three parts; the clypeus is greatly shortened and curved down beneath the front; the epicranium advances forwards and down the front, carrying the antennæ towards the middle between the eyes. We find just this condition of things in *Polystæchotes*. In both genera the simple antennæ are short and feeble, and placed low down the front; the clypeus, which is shorter than broad, presents in its tranverse diameter an irregular, narrow, hexagonal figure; and the eyes are smaller and more globular than usual in both, especially so in *Hepialus*. The whole head, which in the Bombyces is nearly always small and sunken in the wooly thorax, is in *Hepialus* unusually large and free from the thorax.

In the thoracic region the resemblance is still maintained. In the Lepidoptera the middle ring is greatly developed in size over the pro- and meta-thorax, while in the Neuroptera there is a great equality in the three seg-

ments, since the pro-thorax is large and broad. In the meso-notum of *Polystæchotes* (Fig. 2,) we have the præscutum forming a large portion of it, perhaps a little larger even than the scutellum of the segment. In the *Lepidoptera* this scutellum is always large, while the præscutum is minute and concealed, since it is bent down in front of the ring, and is not seen from above; therefore it is very anomalous to find this piece in *Gorgopis* (Fig. 1,) enlarged considerably and occupying a lozenge-shaped area, not hidden between the meso- and pro-thorax, but spread out horizontally, and in the same plane with the large, broad scutum.

Figs. 1, 2.



As will be seen in the figure the pro-thorax of the Neuropter is broad and square, while that of the moth is as usual very short and small.

In *Hepialus* the elongation of the middle region of the body is effected by the unnatural length of the meta-thorax, accompanying which is the enlarged pair of hind wings, a character essentially neuropterous. The meta-thorax in *Gorgopis* is nearly as long as broad, while in other *Lepidoptera* it is but a third as long as broad; the scutum, which in the meso-thorax of *Lepidoptera* occupies nearly the whole notal surface of that ring, is in the succeeding ring divided into two halves, which are thrown aside by the very large triangular scutellum, whose apex joins the same part of a much smaller triangular piece in front, the præscutum, which is always concealed in the *Lepidoptera*, but in *Gorgopis* (Fig. 1,) appears for the first time upon the upper surface of the ring instead of being crowded down in between the two hinder segments of the thorax. A figure of what I have just described will illustrate well the same segment in *Polystæ-*



chotes \* (Fig. 2). Thus, so far as we know, this enlargement of these two præscuta is unique in *Gorgopis* among Lepidoptera, though common in the Neuroptera.

There is also a strong resemblance in the flanks of the three thoracic rings, which in both insects are vertical. In this respect the Bombyces differ from the families below them; thus in the *Noctuæ* they are a little inclined, still more so in the *Geometræ*, and in the *Tineidæ* they are inclined at a still lower angle, and are very slender. So the Phryganidæ, the analogues among Neuroptera, of the Tineidæ, have their flanks inclined at a like angle, besides being much slenderer than usual. In the large coxæ and small trochanters and general correspondence of the size of the legs, *Gorgopis* agrees tolerably with its analogue. But in the wings, and even to the neuration, the analogy is well sustained: in the primaries of both insects the costa is straight to near the apex, where it rounds slowly downwards, terminating in an obtusely pointed, somewhat produced apex; the outer edge is very oblique, and the inner angle in both insects is much nearer the middle of the wing than usual. Also in the wings of both genera the distance between the marginal and costal nervures is greater than usual; and what is an anomaly in Lepidoptera is the presence of a short recurrent nervule or spur, (Fig. 3, *a*,) which the costal sends off from its base across to the marginal nervure. The great number of

\* The outline of the wings of *Gorgopis* is well shown in Dr. Harris's fig. 202; though in a fine species discovered by Mr. Scudder at the base of Mount Washington during the past summer the wings are still narrower and longer, approaching still more exactly the form of those of *Polystœchotes*. This species, which I have called *purpurascens*, differs from the other species, which is sable or tawny brown, in being washed with a purplish tint. But the neuration of this genus is very close to that of *Hepialus*, of which I give a figure from a preparation in the collections of the Museum of Comparative Zoölogy at Cambridge.

Through Mr. Scudder's kindness I can give a figure to illustrate the anomalous appearance of the præscutum of the two hinder rings of the thorax in *G. purpurascens*, since the single specimen, otherwise well preserved, was denuded upon the notum of the thorax.



these recurrences throughout this interspace all along to the apex of the wing is one of the best wing characters in the Neuroptera. Another anomaly in the neurulation of Lepidoptera which occurs in *Hepialus* and its allies, is the great irregularity in the arrangement of the branches of the median nervure. This is seen not only where it throws off its usual four nervules at the outer third of the wing, but in its subdividing into three branches at the basal third of its length to be reunited beyond by cross-veins; which is of a piece with what we find in *Polystæchotes* and its allies generally, where the median nervure is greatly subdivided, to be constantly reunited by cross-veins, thus producing the net-veined character. This for the middle portion of the wing. In the sub-median or inner portion the median sends a spur or cross-vein over to the internal or innermost nervure (Fig. 3, *b*). In the homologous region in *Polystæchotes*, (Figs. 5, 6,) which is all filled up with cross-veins, there is, however, a larger one somewhat isolated from its neighbors, that corresponds exactly to the single spur in *Hepialus*. In both genera the second pair of wings, not much smaller than the first pair, repeat throughout the particular feature in their neurulation I have given above, except that the median recurrent is wanting in the secondaries of *Hepialus*. The abdomen is about three times as long as the thorax in *Gorgopis*; in *Polystæchotes* it is over twice the length; in both it is long and

Figs. 3, 4.



Figs. 5, 6.



cylindrical. There is a general similarity in the terminal segments of both insects and the female genital pieces.

The thin squamation, the nocturnal habits, the stupid, awkward, insensate flight of *Hepialus*, — that of *Gorgopis* I have never seen, — remind us further of the hairy, thin-winged, nocturnal *Polystæchotes punctatus*, which any light attracts after nightfall in the woods of the colder portions of New England.

The *Phryganidæ* as larvæ are like the *Psychidæ* which live in cylindrical cases; and there is between the imagines of many species such a likeness that Newman has placed *Psyche* among the *Phryganids*.

There is also an interesting analogy that the larva of *Perla* bears to the active larva of *Meloe*. Placing the two side by side, we see that both possess a head whose form is broadly triangular, the corners being rounded off. In the three rings of the thorax, which in both larvæ are equal in size and convex on the sides, while the abdominal rings are contracted in length, and slowly taper towards the long setæ which adorn the terminal segments of both insects, and in the closely appressed legs, which are stout and broad, the swollen femora, and the long-clawed tarsi, there are characters which aid in effecting this analogy of *Perla* to a coleopterous insect.

The *Psocidæ* find their analogues in the Hemiptera. The species of *Psocus* are so much like the *Aphidæ* that when flying they are often mistaken for each other. And indeed in the short broad body and broad head and long antennæ, in the very unequal wings, which are folded roof-like over the short abdomen, in their simple neuration, in the short legs, and feeble tarsi, and their mode of flight and appearing winged towards the close of summer, these small insects are remarkably like the winged plant-lice.

The species of *Atropos*, (commonly called book-lice,)

which are wingless, as their name implies, are very much like in form and habits the wingless true lice, which seem by the close resemblance many species bear to young Cimicidæ to be but a family removed from them; being thus low apterous Hemiptera, as fleas are but apterous flies.

The *Formicidæ* among Hymenoptera have in the Neuroptera their well-known analogues, the *Termites* or White Ants. Like the true ants these interesting insects rear nests of sand or clay, or the colonies are concealed beneath various objects, or in decayed trees and roots. There are also a differentiation of the individual, a partition of labor, and wonderful instincts as in ants. Those characters which place the *Termitidæ* the highest in their sub-order, are just those which make them so much like Hymenoptera. Thus in the small occiput, the large epicranium which occupies the largest part of the head, and in the general arrangement of the small mouth-parts, this family differs widely from other Neuroptera. Though the prothorax is large, yet the middle region of the body is massed together more than usual. Like the ants, the costal nervures of the wings are well developed, while those occupying the hinder portions of the wings are obsolete. Indeed, both the true and white ants do not fly much, and that for the most part when swarming.

Upon review, therefore, we find seven out of the eight well-established families of the Neuroptera sustaining this synthetic relation with each of the six other sub-orders; that the strongest analogy exists between the Neuroptera and Lepidoptera, where we find two families of the former sub-order analogous to two lepidopterous families, the Bombyces and Tineæ; and that the less apparent analogy exists between the neuropterous *Termes* and the hymenopterous *Formicæ*.

This synthetic relation is confined to no one natural



group. Within the sub-order of Lepidoptera there is a true and beautiful synthesis located in the Bombyces. Among the twelve sub-families which I have found to compose the single group above mentioned, there are five which are recognized by all lepidopterists to be analogous to nearly every other family of the sub-order. The Lithosiidæ resemble the Tineidæ; *Orgyia*, one of the Liparidæ, is like a Geometrid; the larvæ of Limacodes look like those of Lycæna, and the moths like some Tortrices; different genera of the Notodontidæ resemble the Noctuids and Pyralids; the Platypteridæ also look exceedingly like Geometrids; and the larvæ of *Bombyx mori* and *Endromis* have an anal horn towards which the body increases in size like the larvæ of Sphinx. From this it will be seen that these analogies are confined to similar stages of growth, since the synthesis only occurs between imago and imago, and larva and larva.

Edward Newman was so much misled by these analogies, that, following the septenary arrangement, he placed the Neuroptera in the centre of the other six sub-orders of insects, and the Bombyces in the centre of the families of Lepidoptera. As regards the latter, he considered each of the subdivisions of the family, some of which I have enumerated above, as families ("sub-classes" or "orders") equivalent to other families of insects established by Latreille and now commonly received. How artificial such an arrangement of a limited number of groups into circles is, becomes evident in his confession that "the larva appears to me anything but a guide in the connection of sub-classes."\*

Do we push this inquiry too far when, in considering the great and unusual differences between the families of the Neuroptera, which have led many writers to divide them up into from two to as many as five divisions equiv-

\* *Sphinx Vespiiformis*, p. 38.



alent to other sub-orders, we suggest that these mistaken views are owing to the great variation produced by this synthesis, in connection with the lowness of their type, which besides renders the families when once limited very difficult to arrange in a natural series? By a parity of reasoning, to return again to the Bombyces, I satisfy myself that the subdivisions of that group are in fact sub-families. The Hepiali are the lowest sub-family of the Bombyces; and since the lower genera of most families of insects differ much more among themselves than the highest genera of the same family, I feel convinced that the two groups of genera of which *Cossus* and *Hepialus* are types are but sections of the same sub-family.

EXPLANATION OF THE WOOD-CUTS.

Fig. 1. Thorax of *Gorgopis purpurascens*. ♀ nat. size.

Fig. 2. Thorax of *Polystæchotes punctatus*, magnified.

Figs. 3, 4. Wings of *Hepialus lupulinus*. ♀

Figs. 5, 6. Wings of *P. punctatus*.

*a*, costal recurrents.

*b*, sub-median recurrents.

ART. XVI. — Description of a "White Fish," or "White Whale," (*Beluga borealis* Lesson.) By JEFFRIES WYMAN, M. D., Prof. of Anatomy in Harvard College.

[Communicated April 15th and May 20th, 1863.]

THIS specimen\* was a male, captured in the Gulf of St. Lawrence, and has been on public exhibition in a water tank for nearly two years. He weighed about 700

\* I am indebted to the kindness of Dr. James C. White, Curator of the Society's collection of Comparative Anatomy, for the opportunity of dissecting this specimen. The carcass was presented to the Society by P. T. Barnum, Esq., and the skeleton is to be placed in the Society's cabinet. In the dissection I was assisted by Mr. Horace Mann, of the Lawrence Scientific School.

pounds, is of an ashy gray color, which is nearly uniformly distributed. An obscure band of several inches in breadth, of a somewhat darker tint than the general surface, extends obliquely across the head behind the blow-hole. The hinder border of it is double, and has a semicircular emargination on the middle line; forwards, this band shades off into the tint of the rest of the surface; on either side it ends in an ill-defined oval patch, which surrounds the eye. The edge of the dorsal fin is bordered by a well-marked black band, and another exists on the upper edge of the tail, extends a short distance forwards on the base of it, and backwards between the flukes, (Fig. 3.) The hinder edges of the pectoral limb and of the flukes are each bordered with a narrow dark band.

The *head*, when seen from above, presents a strongly marked oval convexity in front of the blow-hole, consisting of dense fibrous tissue, containing oil, and extending forwards nearly to the lips. The blow-hole is about two inches in length, is concave forwards, and somewhat unsymmetrical, as in many cetaceans, the largest portion being to the left of the median line.

The largest part of the trunk is in front of the dorsal, and is separated from the head by a slight constriction, forming, for a cetacean, an unusually distinct neck. The following table represents the relative position of parts.

	ft. in.
Length of body, . . . . .	10
Distance of blow-hole from anterior extremity of head, in a horizontal line, . . . . .	1 2
Distance of eye from the same point, . . . . .	1
Distance of ear from eye, . . . . .	5
Distance of dorsal fin from end of tail, . . . . .	4 10
Transverse diameter of flukes, . . . . .	2 2
Antero-posterior diameter of flukes, . . . . .	1 2
Length of fore limb, . . . . .	1 2
Breadth of do., . . . . .	9

The dorsal fin is very low, scarcely rising above the

general surface. The tail (Fig. 3) is strongly compressed laterally near the flukes, having a sharp edge above and below; its vertical diameter at its union with the flukes is  $7\frac{3}{4}$  inches, and its transverse 3 inches. The ridges formed by the upper and under edges extend on to the flukes, to within about  $1\frac{1}{2}$  inches of the median fissure. This last is a continuation of the notch on the hinder border of the flukes.

The anal opening (Fig. 6, *a*) is 34 inches from the end of the tail, and in front of it are two small parallel fissures, *b*, each one inch in length and five eighths of an inch apart. These each have within them a papilla, and are undoubtedly male mammary glands. Scoresby has represented these fissures in his figure of a male, but does not mention them in the description. (See his "Arctic Regions," Vol. II. pl. XIV.) The genital opening, *c*, is about six inches in length, and is situated about 11 inches in front of the anus.

*Cervical vertebræ.* Cuvier has already called attention to the most important points in the osteology of the head. The only other parts of the skeleton which seem to require especial notice here, are the cervical vertebræ. These are relatively longer than is usual among cetaceans; in this specimen they, together with the intervertebral substance, are seven inches in length, are wholly separate, and move freely on each other. The atlas and axis are quite massive; the former (Fig. 4) has a thickness of 1.6 inch, on the middle line in front, has no foramen for the vertebral artery, and the transverse processes end in two prominent tubercles (*a* and *b*) on each side; besides the two articular surfaces above and below, there is a fifth, *c*, for the articulation of the odontoid process with this bone; the axis (Fig. 5) has no foramen for the vertebral artery; the body of this bone measures two inches in thickness in front; between the two upper articular surfaces is a high pyramidal eminence, having a nearly circular articular sur-



face, *a*, in front, and of about one inch in diameter; this eminence is a true odontoid process. The third vertebra is the only one of the series which has a foramen for the vertebral artery, the succeeding pieces having only bifurcated transverse processes, except the seventh, which is provided with a short tubercle in place of the anterior branch; it is with this that the head of the first rib articulates, its tubercle being attached to the end of the transverse process of the first dorsal vertebra.

We have then, in addition to a neck, better defined outwardly than is usual with cetaceans, the bones of it presenting a transition from the cetacean to the ordinary mammalian type; *i. e.* all the bones of the neck separated from and moving freely upon each other. In the porpoise and the Greenland whale (*B. mysticetus*) the seven bones of the neck are consolidated into one; in the sperm whale the atlas is separate and the remainder are consolidated. In the herbivorous cetaceans which are true Pachyderms, as the dugong and manatee, the different bones, though quite thin, are always distinct. We have also noticed for the first time, among true cetaceans, in so far as we know, an odontoid process, forming a true articulation with the atlas; no transverse ligament was found.

The number of the *teeth* is as follows:  $\frac{10}{8} \frac{11}{8} = 37$ . They are quite small, the hindmost scarcely projecting above the gums. From the appearance of the lower jaw, it is not unlikely that two of the lower teeth on each side have been dropped, as well as one on the right upper side. If this supposition be correct, the whole number would be forty-two. This number is larger, as will be seen further on, than that given by any of the naturalists who have described the dentition of this species.

The *stomach* was inflated and dried; its cavities, therefore, were not opened. The cuticular lining of the first cavity was easily detached from its connections, and with-



drawn entire through the œsophagus. This cavity contained a collection of stones, nails, pieces of glass, stones of fruits, half digested fragments of the flesh, and a few vertebræ of fishes, also other substances, which had been doubtless swallowed after entering the tank.

The stomach has the complication usual among cetaceans, being provided with five cavities:—first, most capacious, oblong, twenty-one inches in length by twelve inches in its shortest diameter, lined with cuticle; second, very thick and fleshy, eighteen inches long and five inches in diameter; third, quite small, three inches by one and one half; fourth, seven inches by three; and fifth, having the form of an intestine, eighteen inches by three inches.

The length of the *intestines* is sixty feet, the coats of which are very thick and muscular; the valvulæ conniventes of the upper portion are strongly marked, but there is no well-defined difference between large and small intestines, nor any valve to separate them.

The *liver* is remarkably flat, having a transverse diameter of twenty-four inches, and an antero-posterior of about eighteen inches; in its thickest part it measures but little over two inches. The hepatic veins are remarkable for their great size, and continue large even near the anterior borders of the organ, in which respect they resemble the corresponding parts in the seals. The umbilical vein, forming the round ligament of the liver, was freely open and filled with blood. This condition was noticed by Dr. J. B. S. Jackson in his dissections of cetaceans, an account of which was published in the Boston Journal of Natural History, Vol. V. p. 137.

The *heart*, when compared with the size of the animal, is remarkable for its volume and capacity. It was injected, and required thirteen pounds of tallow to fill its cavities. The auricles are very large and prominent; the ventricles are much flattened from before backwards, and

at the apex are separated by a slight notch. The walls of the cavities are quite thin, and in drying diminished very much less than those of the hearts of ordinary mammals. The transverse and longitudinal diameters are about one foot each.

The ascending *aorta* is largely dilated, having a diameter of two and a half inches, becomes somewhat contracted at the arch, and is again enlarged slightly after giving off the left innominate artery, and then contracts to about one inch in diameter. A dilatation similar to that first mentioned, was noticed by Dr. Jackson in *Phocæna globiceps*. Two innominate arteries are given off from the arch of the *aorta*; and the right subclavian, at its origin, lies behind the carotid, instead of being on the outside, as is usual among mammals.

The great size and capacity of the heart, as well as of the whole blood-system, is one of the most striking features in the organization of cetaceans, and has often attracted the attention of those who are in the habit of killing these animals, as well as of naturalists. The explanation of the existence of so much blood we have not seen offered, though we can hardly hesitate in supposing that it is in some way connected with their aquatic habits.

The faculty which whales have of withstanding the effects of interrupted respiration is usually ascribed to the existence of a vascular net-work (*rete mirabile*) connected with the intercostal vessels, which virtually forms a large reservoir of arterial blood. From this the spinal marrow derives its supply, and is thus kept in an active condition, while other organs receive blood which is more venous. While this explanation is doubtless correct as far as it goes, it seems very probable that there is something besides the conditions mentioned which tends to bring about the same end, viz: the power of remaining for a long time under water.

The contrast between the quantity of blood relatively to the size of the animal in which it circulates, when whales and land-birds are compared, is most noticeable, this being, of all warm-blooded animals, at the maximum in the former and at the minimum in the latter. There is also a similar contrast in the power which they respectively have of resisting submersion; birds under this condition perishing speedily, while cetaceans may remain beneath the water many minutes, and occasionally, as we are informed by trustworthy observers, for more than half an hour.

The whole quantity of blood in birds being very small, the supply of oxygen which it contains is rapidly exhausted,—even after a few pulsations of the heart. In whales, on the contrary, the amount of both kinds of blood is relatively very large, and even the venous blood here, as in most other animals, still contains some available oxygen. The blood of these animals must consequently serve as reservoirs of this essential element, from which the tissues at large may draw. The animal which has relatively the largest amount of blood, other things being the same, will resist interrupted respiration the longest.

To the condition mentioned above must doubtless be added another, viz: a greater capacity on the part of whales to carry on vital operations with blood, which, as regards the supply of oxygen, is of an inferior quality. In proof of this we have no facts from which to draw inferences; but if the condition just referred to does exist, it does not in any way weaken the explanation offered with regard to the large quantity of blood in whales.

The *lungs* are very fleshy, not divided into lobes, and are covered by a thick, strong layer of fibrous tissue under the pleura. The trachea is about three inches in length, an inch and three fourths in diameter, has seven complete rings, of unequal breadth, and in some instances



## 610 Description of a "White Fish," or "White Whale."

connected with each other by narrow strips of cartilage. The subdivisions of the trachea are unsymmetrical; the first branch, about half an inch in diameter, is the smallest, and is given off on the right side; the second, an inch in diameter, about three inches lower down to the left side; and the third, of about the same size, is continued in the direct line of the trachea. As stated by Dr. Jackson with regard to the dolphin, a free communication exists between all parts of the lung; by blowing into one of the upper branches of the bronchial tubes, the whole lung was inflated.\*

The intercostal *rete mirabile* is not largely developed, and was not even noticeable, except on cutting through the pleura.

The *eye* is proportionally very small, about an inch in length. The *auditory opening* is, as usual in cetaceans, very minute, of a size sufficient to admit a bristle, and surrounded by a very slight elevation of the integument. The *tongue* is remarkable only for a series of appendages forming a kind of fringe on its border,—such as is seen in the fœtal pig.

The descriptions of this species by different naturalists are quite defective, and render the identification of it quite difficult. By Lacépède and Cuvier, and also by Hamilton, ("Naturalists' Library," Vol. XXVI., Whales, p. 204,) it is described as being without a dorsal fin,—an error which doubtless grew out of the small size of this part. The last-mentioned author states also that the "blow-hole" has its concavity backwards, instead of forwards, as in our specimen. According to Lacépède and Cuvier, the number of teeth is  $\frac{2}{3} \frac{2}{3} = 36$ ; according to Dr. Neil,  $\frac{2}{3} \frac{2}{3} = 30$ ;

\* Hunter states that, in cetaceans generally, the different portions of a lung communicate with each other; but Dr. Jackson has shown that this assertion is not true with regard to the sperm whale, nor the black fish (*D. globiceps*). We have found it true in the little "puffing-pig," or "snuffler," (*D. phocaena*), which we have recently dissected.



Crantz,  $\frac{8}{8} \frac{8}{8} = 29$ ; Anderson,  $\frac{0}{8} \frac{0}{8} = 16$ ; as our specimen has  $\frac{10}{8} \frac{11}{8} = 37$ , and as there are indications, as already stated, that two on each side have been dropped below, and one on the right side above, the full number is doubtless 42. These differences in the enumeration of the teeth depend, as stated by Cuvier, on the age of the animal, — the shedding of them beginning quite early, and eventually, as stated by Anderson, the upper ones are all lost; so that this last-mentioned observer is disposed to place the "white whale" among the cachalots, or sperm whales.

*Habits.* I am informed by Mr. J. A. Cutting, the proprietor of the Aquarial Gardens, and who is a very careful and trustworthy observer, that this animal, during his confinement, showed some capacity for education. He was sufficiently well trained to allow himself to be harnessed to a car, in which he drew a young lady around the tank; he learned to recognize his keeper, would allow himself to be handled by him, and at the proper time would come and put his head out of the water to receive the harness or take food.

At times, he showed a playful disposition, and amused himself sometimes with splashing about in the water, and at others with tossing stones with his mouth. He often took in his mouth a sturgeon and a small shark which were confined in the same tank, and, after playing with them for a while, allowed them to go unharmed.

Mr. Cutting states that the white whale was less docile than the *Delphinus tursio*, who was for a time a companion with him in the tank.

#### *Explanation of Plate XII.*

Fig. 1. Side view of the whole animal, on a scale of one inch to a foot.

Fig. 2. The head seen from above, showing the dark bands, and the unsymmetrical blow-hole.

Fig. 3. The flukes, the hinder edges of which are bordered with a dark tint; there is also a dark stripe on the middle line of the tail.

Fig. 4. Atlas; *a* and *b*, tubercles corresponding with transverse processes; *c*, articulating surface for the odontoid process; *d d*, articulating surfaces for the occiput.

Fig. 5. Axis; *a*, odontoid process and the surface with which it articulates with the atlas.

Fig. 6. Anal and genital region; *a*, anus; *b*, cavities containing the rudimentary mammary glands; *c*, fissure including the male organ.

ART. XVII. — *Remarks on some Characteristics of the Insect-Fauna of the White Mountains, New Hampshire.*

By SAMUEL H. SCUDDER.

[Communicated May 20, 1863.]

It has long been known, through the researches of Humboldt, and others since his day, that as we ascend a high mountain-peak within the tropics or the temperate zone, we pass successively over areas exhibiting distinct features in their vegetation, which remind us more and more of the flora of high northern latitudes. The Alps of Europe have furnished a field for extensive investigations into these interesting phenomena, and their sides have been mapped out into distinct zones or regions, called successively, on an ascending scale, the mountain, the subalpine, and the alpine regions; these regions, with their specific appellations, have been recognized and applied to similar phenomena elsewhere, and are in general use. It has also been noticed, that similar characters are assumed by the animals of the mountain summits, and that these also have their distinct regions, corresponding in all respects with those by which the plants were previously limited.

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Very little attention appears to have been directed to this subject in our country, other than in a most general way. The White Mountains of New Hampshire would naturally attract earliest attention by their high elevation, and by the facilities offered to travellers in their vicinity; but even concerning these, little that is definite has been recorded. Dr. Asa Gray, in his statistics of the Flora of the northern United States,\* gives, it is true, separate and very complete lists of alpine and subalpine species of plants; but the distinction between the two is stated to be, that the former are found only in "our small alpine region," (in which are included *all* the barren summits of the White Mountains,) and the latter "occur mainly in our alpine region, but are also found decidedly out of it;" so that the lists do not pretend to group together those plants which are found each in a distinct alpine or a subalpine region. Prof. E. Tuckerman, in an article upon the Vegetation of the White Hills,† after speaking of the wooded region, says: "Botanists designate the highest, bald district, with the heads of ravines descending from it, as the alpine region, and have sometimes spoken of a small tract intermediate between the two, but still imperfectly characterized, as the subalpine region;" and this is the most definite mention of a subalpine, as distinct from an alpine, region which seems to have been made.

A summer passed at the base of Mount Washington, for the special purpose of collecting the insects of the White Mountains, has given me the opportunity of making many ascents of this highest peak, and of passing over nearly the whole of the barren summits of this easterly range; and this frequent passage from one elevation to another, has afforded the surest means of having the attention repeatedly drawn to whatever distinctions exist

\* American Journal of Science and Arts, XXII. 231; XXIII. 62-3.

† The White Hills, their Scenes, Legends, and History, by T. S. King, p. 232.



between the fauna of the upper and that of the lower regions, and considerable collections have been made for the sake of illustrating such distinctions; on the present occasion, however, I propose to limit myself to a few instances drawn almost exclusively from the Diurnal Lepidoptera.

One feature in the vegetation of the White Mountains strikes the most casual observer in an instant,—the abrupt limits of the forest growth upon the sides of the mountains, marking a very natural division into a wooded and a woodless district. This latter district, on a nearer approach, will, to the observant eye, disclose a further separation into two regions: a lower, where the dwarfed spruce, struggling upwards, conceals the gray rocks in a covering of uniform green, save upon the unstable surfaces of the steeper slopes, or where the land-slips have scarred the declivities with their lengthened furrows; and an upper, more restricted area, in which the barren blocks of stones lie piled in inextricable confusion upon one another, exposed to full view, unrelieved by any grateful coat of green, except by an occasional patch of sedge upon some more favored level spot. These three areas—the forest district, the district of the dwarfed spruce, and the rocky district—exhibit, in a general way, as I believe, the proper limits of the mountain, the subalpine, and the alpine regions; the separation of the mountain from the subalpine region is well marked by the limit of the trees, which is not wholly dependent upon the elevation of the slope upon which they grow, being influenced in part by the ravines which vary the uniformity of their lines, and by the exposure of the sides of the mountain, causing a variation of from one to two hundred feet in perpendicular height. Upon Madison, and the northern slope of Washington, the forest line, as shown by the measurements of Prof. Guyot, reaches to the height of 4150 feet; and upon



the face of Mount Clinton, which has a westerly exposure, it attains an elevation of 4250 feet; while again, at the "Ledge," the extreme northern termination of the north-eastwardly ridge of Mount Washington, its limit is fixed at about 3900 feet. The alpine region seems to occupy the summits of only the three highest mountains; being limited to from one to two hundred feet of the cones of Mts. Adams and Jefferson, and some seven to eight hundred feet of Mt. Washington.

In the accompanying chart of the mountains, (Plate XV.\*) I have attempted to show, by the irregular dotted lines, the general lower limits of the subalpine region, and by the regular dotted lines those of the alpine region. Taking our stand upon the summit of Mount Washington, the main peak, and looking at the mountains which lie to the north of it, it will be seen, that, while the subalpine region follows along the main chain, it extends, also, a short distance along the spur which forms the ridge running south-eastwardly from the peak of Mount Madison, and to a much longer distance northeastwardly from Mount Washington, following the general direction of the carriage road, and terminating at a lower limit than ordinarily at the "Ledge," around which the road abruptly turns immediately before it is lost in the forest. Southwardly from Mount Washington there are three ranges of elevations; a more prominent one, whose peaks bear the names of distinguished statesmen of America, trending towards the southwest; another which continues in the direction of the main chain lying to the north of Mount Washington, whose northernmost peak has received the name of Davis's Spur; and a third, much less significant, dividing the angle between the two former, but approximating much more closely to the last mentioned. By the union of these three,

\* Mainly taken from the Map of the White Mountains published by Harvey Boardman, but enlarged and corrected from observations of my own.

at their junction with Mount Washington, there is formed a broad, far-reaching plateau, sloping gradually away to the south, where the subalpine region enjoys its widest boundaries, whose southern limits I have not fully traced, and the representation of which on the map may be faulty. Within this subalpine region, which includes also the head of ravines, there are several ponds or tarns of small extent: one in Kine's Ravine, the deep gap between Mounts Madison and Adams,\* at the height of 4912 feet; several small ones between Adams and Jefferson; two deeper ones, known as the Lakes of the Clouds, the sources of the Ammonoosuc, lying at the base of Mount Monroe on the side toward Mount Washington, at an elevation of 5009 feet; and other small ones at the southerly base of Monroe. The alpine region of Mounts Adams and Jefferson merely encircles their summits, while that of Mount Washington pushes northeastwardly along the ridge which extends in that direction, occupying one or two successively lower plateaus, and is carried also southwardly, upon the opposite side of the mountain, over the upper portions of the widely extended plateau to the south, known as Bigelow's Lawn, but scarcely reaching so far as the Lakes of the Clouds upon the one side, or the head of Tuckerman's Ravine on the other.

Some thirty-five years ago, Say, in the third volume of his *American Entomology*, described and figured a species of *Chionobas* under the name of *Hipparchia semidea*, from specimens sent to him by Mr. Nuttall and Dr. Pickering.

\* There is a slight confusion in the names applied to the mountains by Prof. Guyot in different parts of his table of their heights, (*Silliman's Journal*, XXXI., 182,) the names of Adams and Jefferson being interchanged; in his Map, he has followed Prof. Bond's very common error in calling Adams, Jefferson, and *vice versa*. The name of Adams was originally applied to the northernmost and higher peak of the two. See Prof. Tuckerman's article in Rev. Mr. King's book on "The White Hills."

"It inhabits," says he, "the bald summits of the White Mountains of New Hampshire, and appears to be limited to that inhospitable region." This species is confined exclusively to the strictly alpine region of the mountain, and is extremely abundant. Under descriptions of this insect, in its various stages, in this paper I shall speak of its habits and stations, and will only say here, that its presence in the alpine region is a very prominent feature in the fauna of the White Mountains;—doubtless an occasional individual will be found far within the limits of the subalpine region, for the fierce blasts of wind, which sweep around these lofty elevations must sometimes hurl these feeble flutterers far down toward the wooded valleys, as, indeed, I have once or twice witnessed, but the contrast between the occasional and unwilling visitor and the swarms which crowd the upper plateaus is very marked and significant. The genus is quite peculiar to the arctic regions. On this continent, it has been recorded as yet only in Greenland and Labrador, and at Albany River, Hudson's Bay, about latitude  $53^{\circ}$ ; and I presume all Eastern Labrador specimens have been obtained from that portion of it lying to the north of the Straits of Belle Isle, since none were brought home by an expedition which spent the summer just south of that point, notwithstanding special search was made for them; neither did I meet with them in a summer's trip in the centre of the continent, across Lake Winnipeg and up the Saskatchewan River, nearly to Cumberland House, in latitude  $54^{\circ}$ . So here we have, upon the highest altitudes of the mountains, a butterfly belonging to a genus found elsewhere only in high northern latitudes. According to Mr. Edwards, it is specifically distinct from that found at Albany River, but whether or not it is distinct from those of Greenland and Labrador, or the numerous, but most closely allied species which



have been described and figured from northern Europe, I cannot, from the confusion in which the species of this genus appear to be, and from the want of any specimens from other quarters, at present determine, — but satisfy myself, on this occasion, with a more detailed description of the species than has yet been given; only suggesting, that should it ultimately prove to be distinct, it will only be a case analogous to what we find in the species next to be mentioned.\*

I have found at three localities so separated as the summit of Mount Madison, the head of Tuckerman's Ravine, and a short distance above the Ledge, (all, it will be noticed, within the subalpine region,) a species of *Argynnis*, described below in honor of the god of the mountains, belonging to that group of the genus to which *A. Amathusia* Ochs. pertains. Without a critical examination, it would not be distinguished from *A. Boisduvalii* Sommer, which I do not consider, as Boisduval does, to be synonymous with *A. chariclea* Ochs. The character of the relationship of *A. Boisduvalii* and *A. Montinus* is such that they would come under the denomination of representative species in the limited sense to which I have attempted to restrict it in my paper on the Genus *Colias*.† To the points of distinction between them I shall not, however, here allude, reserving such remarks for a future occasion, when I shall speak at length of the boreal species of this genus; but we

\* In a letter written by Dr. Harris to Mr. E. Doubleday, of England, dated March 24, 1849, occurs this remark: "Boisduval, in his *Icones Historiques des Lépidoptères nouveaux*, &c., Vol. I. p. 197, under *Chionobas Also*, makes the following blundering remark, 'J'ai reçu de M. John Le Conte, sous le nom d'*eritiosa* [!] de Harris, [!] un individu pris dans les montagnes calcaires [!] de New Hampshire, qui me paraît appartenir à cette espèce.' Boisduval's *Also*, published in 1832, is very possibly identical with Say's *semidea*, published in 1828; and if so, the latter name alone can stand. The specimens which Le Conte sent to Boisduval he received from me, with Say's *Egeria exitiosa*; whence, probably, the blunder of the specific name. My specimen of *Hipparchia semidea* was taken on the summit of Mount Washington, one of the loftiest peaks of the White Mountains, which, by the way, are not "montagnes calcaires."

† Proc. Bost. Soc. Nat. Hist., IX. 106.



have, I will say, two species belonging to this section of the genus, ranging from South Labrador to Great Slave Lake, and occupying (so far as my actual observations extend) a region of country lying south of that wherein the genus *Chionobas* flourishes. This section of the genus is, then, characteristic of the boreal and subalpine regions, just as *Chionobas* is of the arctic and alpine.

Within the limits of the subalpine region there is also found an Orthopteron belonging to the Genus *Pezotettix*, to which, in the descriptions which follow, I have given the name of *P. glacialis*. In Europe, the different species of this genus have been found only in elevated situations or high northern latitudes. M. de Saussure has, however, described species on this continent from Labrador to Mexico, but I can with difficulty believe that they should be generically associated. The only species on this continent I have myself seen, is the one here mentioned, and that formerly described by me from Lake Winnipeg and Anticosti, and until more complete descriptions are furnished by M. de Saussure, I shall still consider it a boreal and subalpine genus.

Passing lower, we find the mountain or wooded region corresponding altogether with the Canadian Fauna; and since the boundary line of the Canadian and Alleghanian Faunæ upon either side of the mountains is at just about this latitude, we may consider this a promontory of the Canadian Fauna stretching southwardly along the mountain chain, into the Alleghanian; while the Alleghanian, in its turn, creeps into the region of the Canadian Fauna along the warmer banks of the rivers flowing southeastwardly. One has but to pass eight miles to the northeastward of Mount Washington to have recalled to him, in the valley of the Androscoggin, the Entomological Fauna of the central portions of the New England States. In this mountain region we have such phenomena as the re-

placement of *Grapta Comma* Doubl., of the Alleghanian Fauna, by *G. Faunus* Edw., and of *Argynnis Aphrodite* Fabr. by *A. Atlantis* Edw. Here, then, we have three distinct faunæ upon the slopes of the White Mountains, each with its characteristic forms; and however much one may be prepared to expect some difference between the animals of the extreme barren summits and those of the sheltered valleys, these distinct faunæ, so clearly marked, each harboring their peculiar forms of life, which live, as it were, within a stone's throw of one another, and yet do not overleap their imperceptible barriers, which are capable, it would seem, of interchanging their stations in the freest way, and yet prefer their own homes, cannot fail alike to astonish and to interest. Many of the butterflies of the valley occasionally struggle to the extremest summits, and one or two, such as *Grapta Faunus* Edw., and *Vanessa Milberti* Godt., are found, not infrequently, within the subalpine region; with them all the capabilities of flight are unlimited, yet I have but once or twice taken *Chionobas semidea* more than a mile and a quarter from the summit; and the very limited appearance of the others upon the mountain summits (which may be easily accounted for by the fact that all insects, which are not essentially ground-insects, seem to delight in flying to the most elevated situations) is in marked contrast with their amazing abundance within their proper and assigned limits; for there is no species of butterfly in the valleys, at all characteristic of the Canadian Fauna, which I have not found at its season in the most wonderful profusion.

The results to which we are brought, by an examination into the character of the faunæ on the mountain slopes of New Hampshire, are what we should have expected on a comparison of the elevation to which they have been raised with that of the Alps of Europe, provided we take into consideration the difference in climate between the

two countries ; upon the Alps, the lower limit of the sub-alpine district is placed, by different botanists, at from 4000 to 4500 feet, and that of the alpine, at from 6000 to 6500 feet. Now, although Mont Blanc is in a latitude north of Mount Washington by a degree and a half, yet the isothermal and isochimenal lines which pass respectively through these two points, would, when compared together, show, that a mountain elevation in Europe, to have similar climatic conditions to those of the White Mountains, ought to be placed to the northward of the Alps, and would be found in just such a relative position between the mountains of Switzerland and Norway, as the limits of the alpine and subalpine districts of the White Mountains are found to be related respectively to those of the Alps and Scandinavian mountains. And by these same comparisons we may judge, that if the summit of Mount Washington were somewhat less than 2000 feet higher, it would reach the upper limits of the alpine district, or the region of perpetual snow.

CHIONOBAS SEMIDEA Edwards in Morris' Synopsis Lepid.  
N. Amer. p. 351.

*Chionobas semidea* Scudd. Proc. Essex Inst. III. 169.

*Hipparchia semidea* Say, Amer. Entom. Pl. 50.

“ “ Say, Entom. N. Amer. edit. Le  
Conte I. 113, Pl. 50.

“ “ Harris, Ins. Inj. to Veg. 3d ed.  
304, Fig. 126.

Wings dull brownish fuscous tinged with ochraceous ; fringe blackish brown interrupted between the nervure tips with ochraceous, dark brown along inner edge of secondaries. Above : *Primaries* nearly uniform in tint ; basal half of costal edge with minute alternate black and whitish bars, the markings of the under surface indicated faintly



above by the transparency of the wing. *Secondaries*, with the basal half to a little beyond extremity of cell, a little darker, and the markings of under surface appearing above, as in primaries. Beneath: *Primaries*, marbled with small narrow transverse bars, darkest toward the apex, formed of blackish-brown scales, not very closely connected; the interspaces, at the extreme tip, white or grayish white; whole costal edge with short alternate black and white bars. *Secondaries* marbled, as in the primaries, but much more heavily, and with the scales of the transverse bars black and confluent; a narrow band of white scales crosses the wing in the middle, subparallel to the outer border, occasionally somewhat regularly curved, but most generally rather abruptly bent just beyond the tip of the cell, where its inner border is as far beyond the tip of the cell as the width between the nervures at this point; its inner border is well defined, crenate, its outer merging into the marbling beyond; crossing the wing half way between its base and the extremity of the cell is another similar, generally less distinct, whitish band, subparallel to the first; the basal half of the wing is the darkest, and against the inside of the first band and the outside of the second, the black bars are clustered so closely as to be confluent, and form bands bordering the white bands, and of nearly the same width; beyond the outer band, the interspaces between the black bars are more or less occupied by white scales; at the extremity of the nervures are situated broader black bars, which sometimes form a continuous hind margin to the wing.

Body black, covered with blackish and yellowish brown hairs, the latter especially on the abdomen and beneath; back of head and front of thorax with many grayish scales; palpi with long black hairs outside, shorter whitish ones inside and above; antennæ brownish yellow, with a line of black scales continued to the tip above, and of



white scales on the basal half below. Expanse of wings  $1\frac{4}{5}$ –2 inches.

The males and females do not differ, as Harris states; the primaries of the male are perhaps a little more pointed at the tip than those of the female, but there is no difference in the markings, unless it be that there is usually more marbling on the disk of the under surface of the primaries in the females than in the males.

**EGG.** Taken from body of living female; pale yellowish-green, nearly colorless; spherico-ovoid, largest at base; with about 25 ribs, which are rather broad, prominent, transversely wrinkled, slightly sinuous in direction, most of them extending to the apex, and below nearly to the centre of the base, and where they vanish, the surface is well punctured and rugulose; height,  $\frac{1}{20}$  inch; diameter,  $\frac{1}{30}$  inch.

**LARVA.** Head brownish yellow, with three bands of black spots on either side, which are little raised points, giving rise, each, to a hair, the space between them being brown; the first is broadest, and follows the middle suture, and half way down the side of the triangular suture; the second is separated from the first by the width of the latter, is parallel to it, of equal length, and slightly narrower; the third is narrow, nearly linear, short, consisting of only ten or twelve black dots, placed upon the middle of the sides, directed horizontally, not parallel with the others; there is also a fourth, as short as the third and still smaller, beneath, arising from in front of the first pair of legs, and running at right angles to the third; the triangular suture is dark brown; a dark dot just behind the antennæ; first joint of antennæ mammiform, dusky; second very short, scarcely perceptible except by black color; third cylindrical, twice as long as broad, squarely docked, reddish brown; labrum black; mandibles reddish, black at tip; maxillæ 3-jointed, each successive joint smaller, dusky, the last

darkest; labium dark-brown; ocelli five in number, four in a rather open curve, convex in front, one below, separated considerably from the upper three, which are crowded, and are directly behind it at a little greater distance; all black, except the uppermost, which is reddish brown; the lowest of the upper three larger than any of the others, which are equal. The segments behind the abdomen have five longitudinal bands, a dorsal, subdorsal, and lateral; a narrow black dorsal band, enclosing little longitudinal rather pale green spots or dashes on the apical half of each segment, those of the thoracic segments uniting to form a narrow line; this band tapers at each end, and is about .015 inch in extreme breadth; the subdorsal is a very narrow interrupted black band, narrower than the dorsal, the dashes of which it is composed being situated principally upon the anterior portions of segments, and arranged a little obliquely, the anterior extremities being directed downwards; the dorsal and subdorsal are separated by a space which is .035 inch in breadth, pale yellowish green, tinged with faint reddish brown at the apical half of each segment; the lateral band is separated from the subdorsal by a similar distance, and is itself of the same width; it is dark green, edged at its upper border with black, which is diffused downwards slightly at the base and apex of each segment, especially on the abdominal ones; the space between subdorsal and lateral bands is like that between dorsal and subdorsal, except in being considerably tinged with reddish brown; below the lateral band the body is grass-green, with a flush of roseate in it, the spiracles being black; the under surface and prop-legs are uniform grass-green; legs dusky. The whole body is covered with very short delicate reddish hairs arising from minute pale warts; the body is cylindrical, thickest at the apodal segments, narrowed gradually behind, a little more rapidly in front; head rather small;

each half of anal segment conical, not very bluntly pointed. Length .94 in.; greatest breadth .22 in.; breadth of head .1 in.

PUPA uniform reddish brown, compact, well rounded; the dorsal curve of the abdomen full and regular, that of the thorax rather high, slightly depressed above; the dorsal elevation of the thorax laterally compressed, terminating in a furrow which is in continuation of the hind edge of wings; the shoulders at base of wings are rather prominent, the head obtuse and regularly rounded; abdomen cylindrical, tapering very regularly and rather rapidly to the apex, which is blunt, and has an oval depression on the under surface, with broad heavy border; the ventral surface is somewhat flattened; dorsum of thorax with very slight transverse wrinkles, and a few oblique heavier ones; abdomen smooth. Length .56 in.; breadth across abdomen .24 in.; breadth at base of wings .21 in.

This butterfly begins to appear by the first of July, and perhaps earlier, and continues until about the 10th of August; they are laying their eggs at least until the 22d of July, and probably a little later; caterpillars were taken nearly, if not quite, full grown on August 2d, and others fully grown on August 19th; only one was taken alive, upon a rock, apparently feeding upon lichen;\* an attempt to raise it in the valley below proved unsuccessful, although it lived for a long period. The other specimens were obtained drowned in pools of water, a very satisfactory mode of collecting upon Mount Washington; the description of the colors was taken from the living insect. Of the pupa I have only obtained fragments and injured specimens under rocks, where they can doubtless be found in some abundance when searched for at the proper time. The most favorable localities for collecting the butterfly that I

\* Since this was written, in company with Mr. Horace Mann, I have again taken specimens of the living caterpillar, feeding upon the same lichen, which has been determined by Mr. Mann to be *Peltigera canina* Hoffm.



have found is on the sedgy plateaus either on the northern or southern side of Mount Washington, from one quarter to three quarters of a mile from the summit; other insects of the alpine region may be found most abundantly upon the stones which have been piled up by enthusiastic pedestrians upon the various isolated elevations, forming pillars of three or four feet in height; those upon the summits of Mount Adams have furnished me the richest harvests.

ARGYNNIS MONTINUS SCUDD., Proc. Essex Inst. III. 166.

Above, deep fulvous, marked with black, with black nervures. *Primaries*. A rather narrow, interrupted, zigzag mesial band, consists of five dashes: the first starts from the upper branch of subcostal nervure at three fifths the distance from the base of the wing, and crosses the spaces between the subcostal nervules in a direction at right angles to the uppermost, and is sometimes connected above with the costal border by a small spot; the second crosses the space between the adjacent nervules of the subcostal and median nervures in the same direction, but removed outwards from the first by its own width; the third crosses the space between the uppermost branches of the median in the same direction, but removed inwards from the second by double its own width; the fourth, with its inner border scarcely removed from the divarication of the uppermost branches of the median, crosses the next space at right angles to the nervules; the fifth crosses the space between the median and submedian, at right angles to the nervules, removed outward from the fourth by its own width; the inner border, up to this part, is dusky, as is the base of the wing; within the mesial band there are three short transverse bands crossing the cell, the outermost bordering it, and the innermost only not reaching the median nervure, and frequently having a fulvous central streak; another spot is frequently seen within these when not ob-



scured by the duskiess of the base of the wing; a short patch, starting from the divarication of the median, crosses half way to the submedian, turns abruptly inwards a short distance towards the base, terminating in a point; the outer margin of the wing is rather broadly bordered with black, inclosing, between it and a row of triangular black spots, a series of fulvous transverse streaks, sometimes continuous, usually largest towards the inner angle; midway between the row of triangular spots and the mesial band is a row of rather large black spots, slightly curving, usually larger toward the inner angle, the lowermost thrown a little outside of the curve; on the costal border, midway between this row and the mesial band, a triangular dusky patch, extending just over the penultimate branch of the subcostal nervure.

*Secondaries.* The markings are entirely as in *A. Boisduvalii* Somm., except that the duskiess of the base extends farther, frequently obscuring the markings within the mesial band, and the roundish spots are, in general, larger; fringe of wings pale, at base fulvous, interrupted with black.

Beneath: *Primaries*, fulvous, with the markings of the basal portion of the upper surface repeated, but the mesial band more interrupted; the row of roundish spots is only partially repeated, generally only in the middle of the wing, that between the ultimate branches of the subcostal nervure being bordered with ochraceous; the apical portion of the tip of the wing is cinnamon-red, extending from a little outside the mesial band to the termination of the lowest median nervule; the nervules within this patch are ochraceous from the border to a point corresponding to the triangular spots of the upper surface, which are generally only indicated as dusky arrow-head spots; there is a short ochraceous streak extending from the tip inwards and downwards, and another, smaller and less distinct, parallel to it, within, on costal border.

*Secondaries* deep cinnamon-red. Two broken black lines traverse the wing: the first starting from the costal, crosses the space between it and the subcostal at an angle of  $45^{\circ}$  to the latter, and striking a little within its bifurcation, starts again from the bifurcation, and following generally the outer limit of the cell, sweeps round to the bifurcation of the median, whence, with a succession of regular sweeps, it reaches the inner border; the second is composed very distinctly of three parts; the first of those starting from the costal and reaching the subcostal, takes a direction nearly parallel to, but turned inward a little more than, the previously mentioned line, so that, if continued, it would strike the last bifurcation of the subcostal; the second part starting a little beyond a point on subcostal opposite the origin of the line upon the costal, traverses the next two spaces at right angles to the nervules, with a shallow curve opening outward; the third part originating on the last nervule of the subcostal, at a point as far removed from the second part of the line, as the second is from the first, crosses to the inner border, taking a general direction parallel to the first line, by a series of irregular broken lines or shallow curves, the first opening inwards, the other outwards. These two black lines are narrowly bordered on the sides toward one another with ochraceous scales, generally more prominent upon that portion of the first which crosses the spaces between the costal and subcostal and between the subcostal and median nervures, frequently forming conspicuous patches, occasionally more or less interspersed with whitish scales; generally the main space between the two black lines, which in *A. Boisduvalii* forms the broad medial band, is of the same cinnamon-red as the immediate base; at the base there is a white spot between each of the principal nervures, and a small black spot, faintly bordered with white, in the middle of the cell; apical half

of wing nearly or quite of the same cinnamon-red as the base; next to the outer border a row of transverse white spots, very indistinct or almost wanting at the middle, larger and more conspicuous at the outer angle; these are surmounted by triangular cinnamon-red spots, bordered faintly with ochraceous scales, especially that between the last branches of the median and the inner border of the one between subcostal and median; adjoining the tips of the triangular spots is a faint row of narrow circlets of ochraceous scales enclosing cinnamon-red spots, generally a little deeper in color than the base of the wing; between these and the outermost black band is a very narrow faint band of rosy-white scales, barely seen to be formed of lunules opening outwards.

Body covered above with olivaceous hairs, mixed with fulvous on head, shoulder-covers, and towards extremity of abdomen; below greenish yellow mixed with fulvous on thorax; palpi fulvous above and at the tip, ochraceous below, with intermingled black hairs; stalk of antennæ fulvous below, bordered finely with white, black above, with narrow white annulations; club of antennæ black, tip below fulvous. Expanse of wings 1.66–1.8 in. The males and females do not differ.

This species was first seen by me on July 21st, 1862, at the "Ledge," and again August 2d, at same place; at the head of "Tuckerman's Ravine" August 11th, several specimens were taken in good condition, and many more seen on the summit of Mount Madison August 18th; a single specimen, labelled New England, is in the Museum of Comparative Zoölogy. I have never seen the caterpillar or pupa; specimens of the imago taken August 2d were full of eggs, some of which, flattened by accidental pressure, were secured; they were longitudinally and rather closely ribbed, and transversely wrinkled, the ribs being only moderately prominent, extending to the apex, but



apparently not turning the angle of the base. Diameter very nearly .04 in., height fully .04 in.

PEZOTETTIX GLACIALIS, nov. sp.

Allied to *P. salamandra* Fisch. Head not large; occiput swollen; vertex with a broad shallow sulcation (♀) or narrow, but not deep (♂), slightly depressed transversely between the eyes; frontal ridge with a deep sulcation, and a depression at the central ocellus; eyes not so prominent as usual in the genus, not elongated, docked anteriorly, and very slightly above; antennæ slender, equal in both sexes, as long as head and thorax; pronotum a little widest posteriorly, margin straight both in front and behind, with a minute central emargination anteriorly; lateral carinæ scarcely apparent, median very slight; sternal spine prominent, laterally compressed, blunt (♂), rather short, blunt, conical (♀); meso- and metanotum wingless, similar altogether to abdominal segments; hind femora above, with square lateral carinæ and a sharp median carina; abdomen laterally compressed, with a distinct median carina extending faintly on to meso- and metathorax; centre of subgenital plate tuberculated.

♀; vertex of head, dorsum of thorax and abdomen olivaceous green; a broad black band behind the eye, reaching the posterior margin of prothorax, continued posteriorly over half the length of abdomen as an interrupted band by a series of dark transverse streaks at base of segments; below this, on sides of thorax, bright greenish yellow, with a black spot on middle of lower border of prothorax; beneath, greenish yellow, prosternum dusky, tubercle tipped with brown; front and sides of head yellowish green, with a greenish streak down the middle of frontal ridge; labium, maxillæ, tip of labrum and of clypeus pale bluish white; both pair of palpi yellow, terminal joint rimmed with brown; tip and extreme base of mandibles black; anten-



næ yellowish brown, paler below, darkest at tip, towards base greenish; fore and middle legs olivaceous green, tinged with yellowish beneath, last joint of tarsi darker, especially at tip, claws tipped with black, arolium reddish brown, margined broadly with black; under surface and lower half of inner surface of hind femora coral-red, remainder yellowish grass-green, with two broad bands of dark-green across the outside, apex black; tibiæ green, tarsi paler, terminal joint and arolium as in the others; anal appendages dirty yellow, tipped and edged with black.

♂ differs from ♀ in having the pronotum and front of head more yellowish, the prosternum black, its spine uniformly pale green, and the parts behind the prothorax as follows: meso- and metasternum bright green; sternum of abdomen yellowish green, slightly paler than sternum of thorax, with the apical border of the segments bordered narrowly with dusky, and the basal rather broadly with black; basal half of terminal segment black, apical yellowish green; whole dorsal surface black, with a dorsal row of yellowish-green spots, and a triangular spot of same color between the coxæ of middle and hind legs; a lateral row of greenish yellow spots on 1-8 abdominal segments, each with a dark arcuate streak above, its concave side toward the brownish spiracles; anal appendages black.

Length ♂ .65 in.; ♀ .82 in.

EXPLANATION OF PLATE XIV. \*

Fig. 1. *Argynnis Montinus* Scudd.

Fig. 2, 3. *Chionobas semidea* Edw. Chrysalis.

Fig. 4. " " Imago.

Fig. 5, 6. " " Larva.

Fig. 7. " " Head of Larva.

Fig. 8. " " Terminal segment of Larva.

Fig. 9. *Pezotettix glacialis* Scudd. ♀ side view.

Fig. 10. " " " ♂ dorsal view.



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## ERRATA.

- Page 2, l. 34, for *Fenessac* read *Ferussac*.  
 " 5, l. 39, for *R. T. Shuttleworth* read *R. J. Shuttleworth*.  
 " 6, l. 10, and elsewhere, for *Drapanaud* read *Draparnaud*.  
 " 7, l. 32, for *nemoraviga* read *nemorivaga*.  
 " 8, l. 14, " " " "  
 " 10, l. 6, for *redimita* read *redemita*.  
 " 11, l. 11, for *indenta* read *indentata*.  
 " 13, l. 1, for *decendens* read *descendens*.  
 " 20, l. 17, for *superi* read *superiores*.  
 " " l. 22, for *occulta* read *occultata*.  
 " 26, l. 21, and elsewhere, for *Riegen* read *Reigen*.  
 " " l. 29, for *epiderme* read *epidermide*.  
 " " l. " for *mostrantibus* read *monstrantibus*.  
 " 28, l. 6, for *Mörk* read *Mörch*.  
 " " l. 20, for *tenuiscula* read *tenuicula*.  
 " 38, l. 33, for *orbiculata* read *orbiculato*.  
 " 44, l. 28, for *columella* read *columellar*.

- Page 48, l. 9, for 7. read .7.  
 " 49, l. 35, for *Brandybæna* read *Bradybæna*.  
 " 51, l. 2, for *its* read *it*.  
 " 53, l. 8, for *subdilata* read *subdilatatâ*.  
 " 55, l. 23, for *tenui* read *tenuis*.  
 " " l. 28, for *dilitato* read *dilatato*.  
 " 57, l. 12, after 100), read ".  
 " 58, l. 2, for *odstricta* read *obstricta*.  
 " 59, l. 32, for *Juhn* read *Jan*.  
 " 63, l. 18, for 7, 9 read 7-9.  
 " 64, l. 20, *dele* ?.  
 " 65, l. 18, for *Waschita* read *Wachita*.  
 " " l. 26, for *Cattahoochee* read *Chattahoochee*.  
 " 78, l. 29, for *New Brauenfels* read *New Braunfels*.  
 " 80, l. 14, for *connectans* read *connectens*.  
 " 90, l. 14, for *genahelte* read *genabelle*.  
 " 91, l. 17, for *prædito* read *prædito*.  
 " 93, l. 3, for *Cattahoochee* read *Chattahoochee*.  
 " 99, l. 5, for *inffcta* read *infecta*.  
 " " l. 6, for *coruco* read *corneo*.  
 " " l. 14, for *isculis planu* read *planiusculis*.  
 " " l. 16, for *diametri* read *diametris*.  
 " 103, l. 4, 9, for *Lavellema* read *Lavalleana*.  
 " " l. 22, for *Yucatenensis* read *Yucatanensis*.  
 " 124, l. 7, for *limited* read *limital*.  
 " 125, l. 29, for *Skenca* read *Skenea*.  
 " " l. 36, for *consists* read *consist*.  
 " 130, l. 20, for *liqualis* read *liquabilis*.  
 " 131, l. 29, for 88 read 80.  
 " 133, l. 2, for *convexiusculis* read *convexiusculi*.  
 " 135, l. 19, for *Macroceramus* read *Macroceramus*.  
 " 136, l. 31, for *Guilliani* read *Guillani*.  
 " 138, l. 33, for *gracillmus* read *gracillimus*.  
 " 146, l. 9, for 17 read 16.  
 " 153, l. 20, for *Thassilophila* read *Thalassiphila*.  
 " 154, l. 18, " " " "  
 " 166, l. 16, *dele* !.  
 " " l. 28, for *Goldfus* read *Goldfuss*.  
 " 177, l. 22, for *Hauptwindung* read *Hauptwindung*.  
 " 181, l. 10, for *Bourgignat's* read *Bourgignat's*.  
 " 187, l. 16, for *Caribæensis* read *Caribbæensis*.  
 " 191, l. 24, for *Cincinnatiensis* read *Cincinnatiense*.  
 " 194, l. 27, for *Jahn* read *Jan*.  
 " 200, l. 4, for 119 read 117.  
 " 257, l. 25, for *sambucci* read *sambuci*.  
 " 258, l. 5, " " "  
 " 339, l. 28, for 74 read 73.  
 " 409, l. 22, for *May 21st* read *June 18th*.  
 " 413, l. 26, for *Labidura* read *Spongophora*.  
 " 418, l. 6, double the measurements.  
 " 420, l. 2, for *width* read *length*.  
 " " l. 13, for *last* read *fifth*.  
 " 427-9, in all the species of the genus *Gryllus* double the measurements given in numerals.  
 " 446, l. 32, for *retinervis* read *retinerve*.  
 " 451, l. 21, for *brevipennis* read *brevipenne*.  
 " " l. 34, for *ensifer* read *ensiferum*.  
 " 452, l. 4, for *brevipennis* read *brevipenne*.  
 " 453, l. 18, for *longipennis* read *longipenne*.  
 " 545, l. 18, for *Carduella* read *Carduella*.

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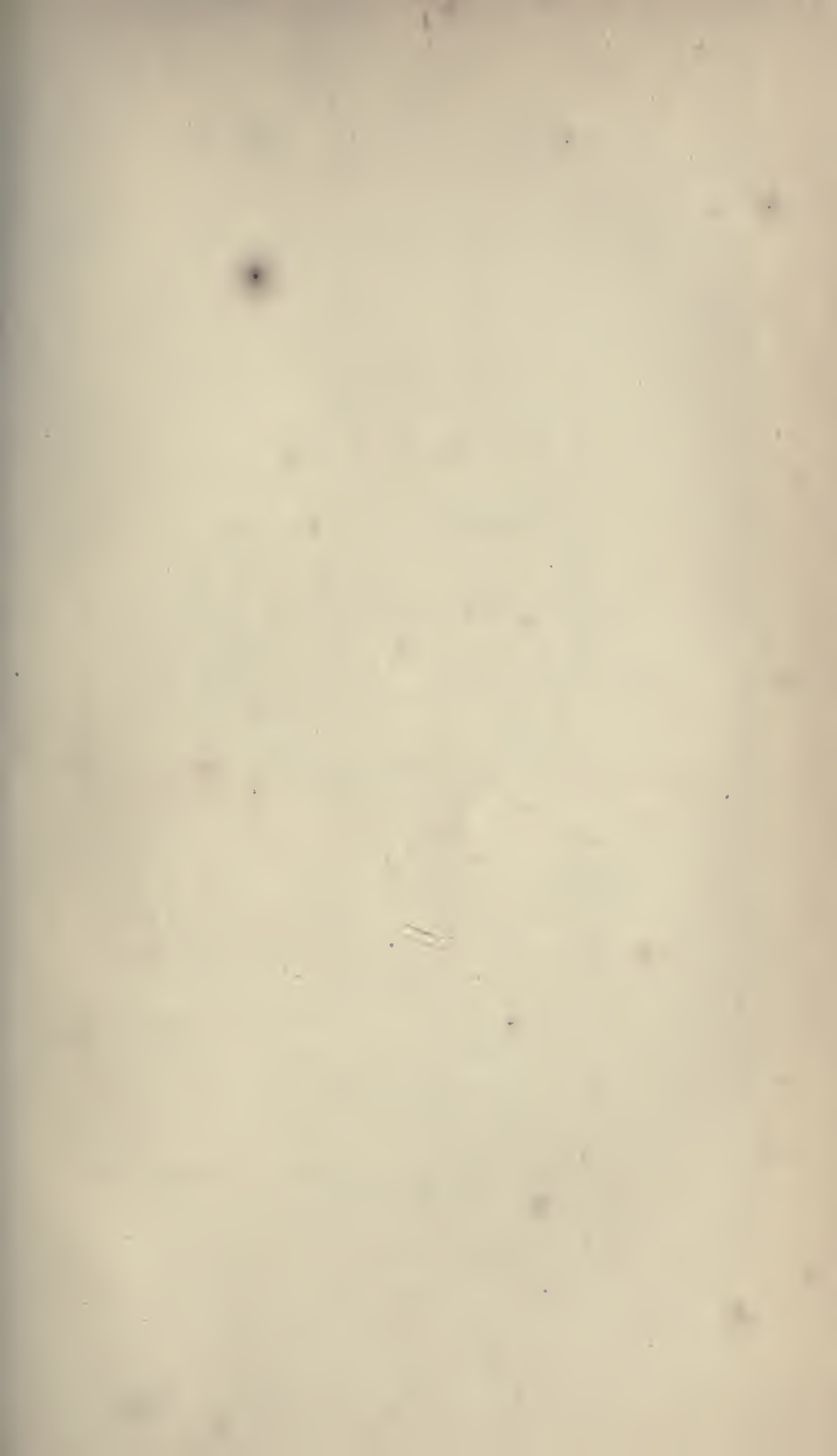
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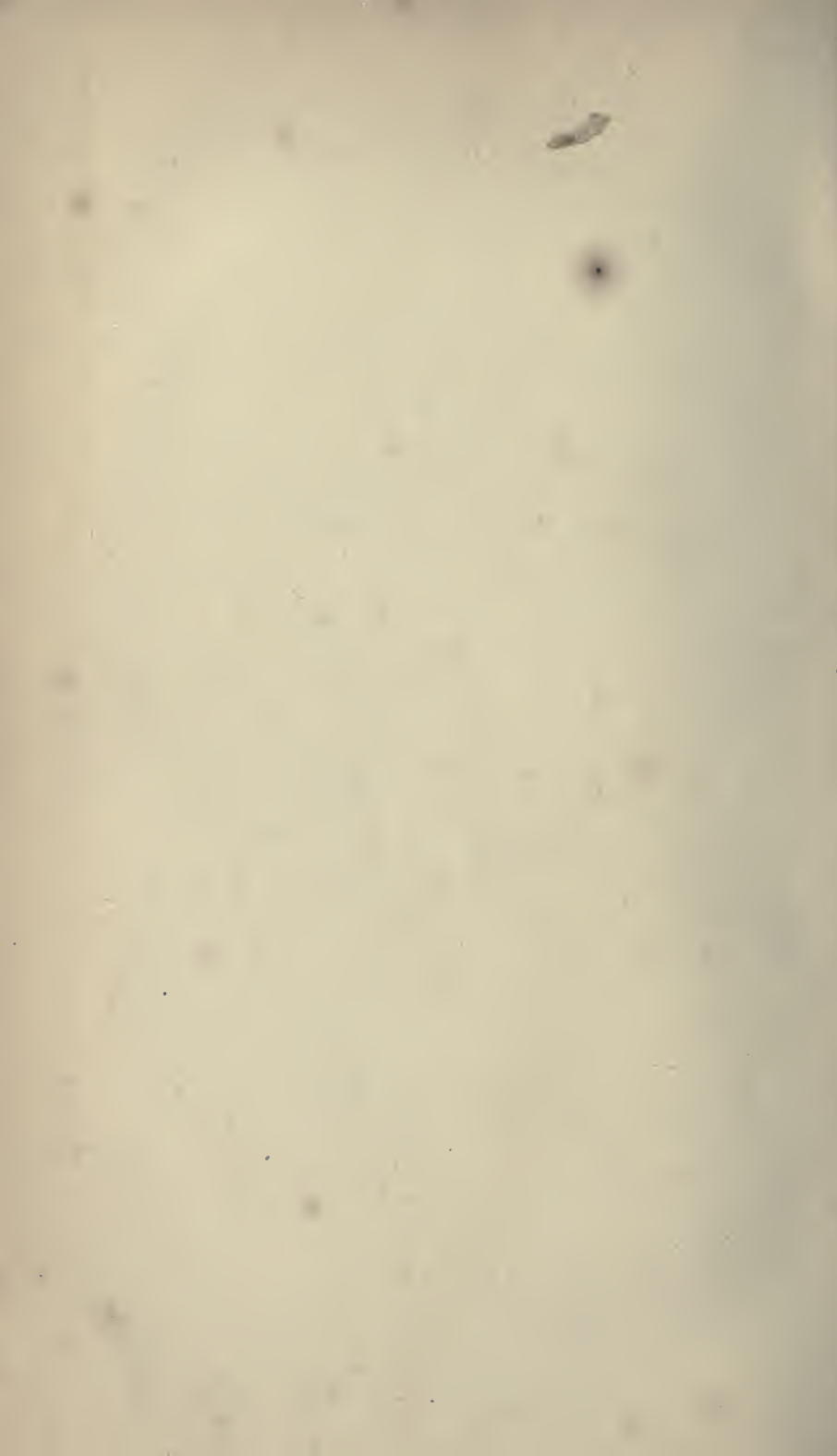
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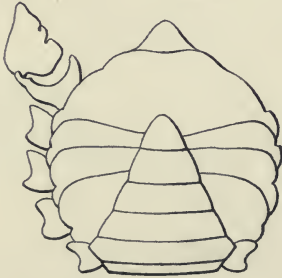
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2



4.



3

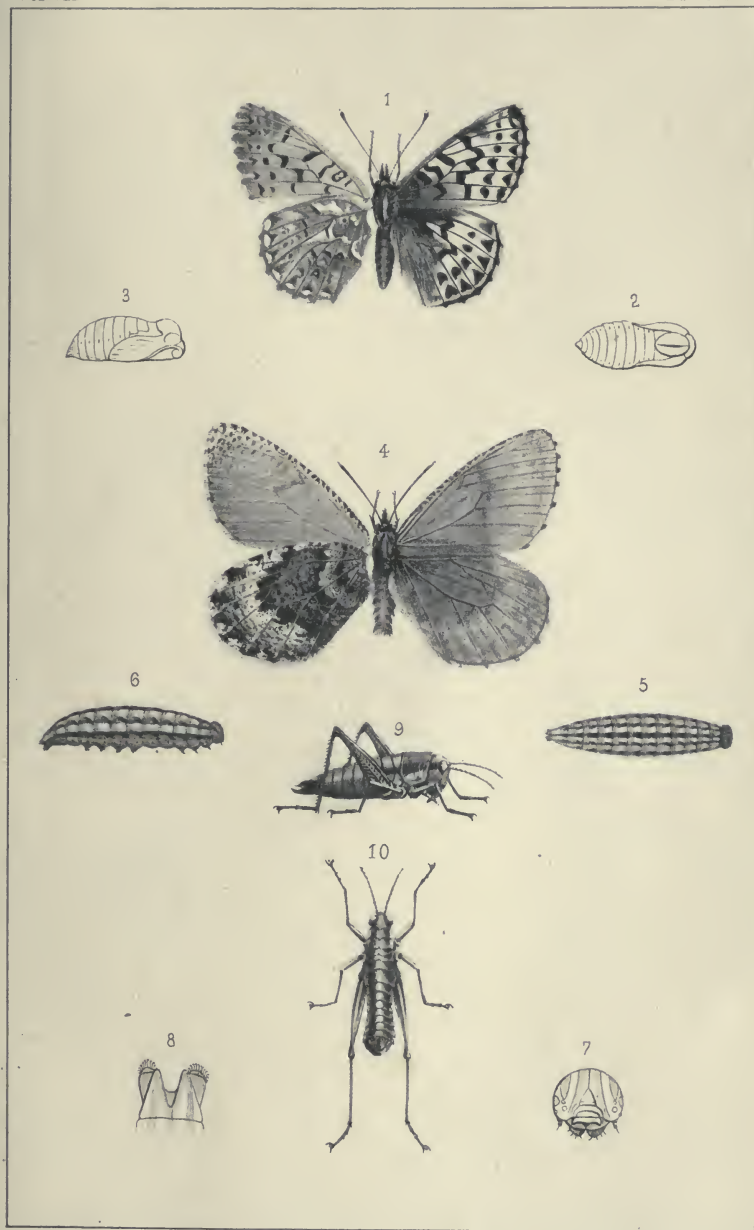
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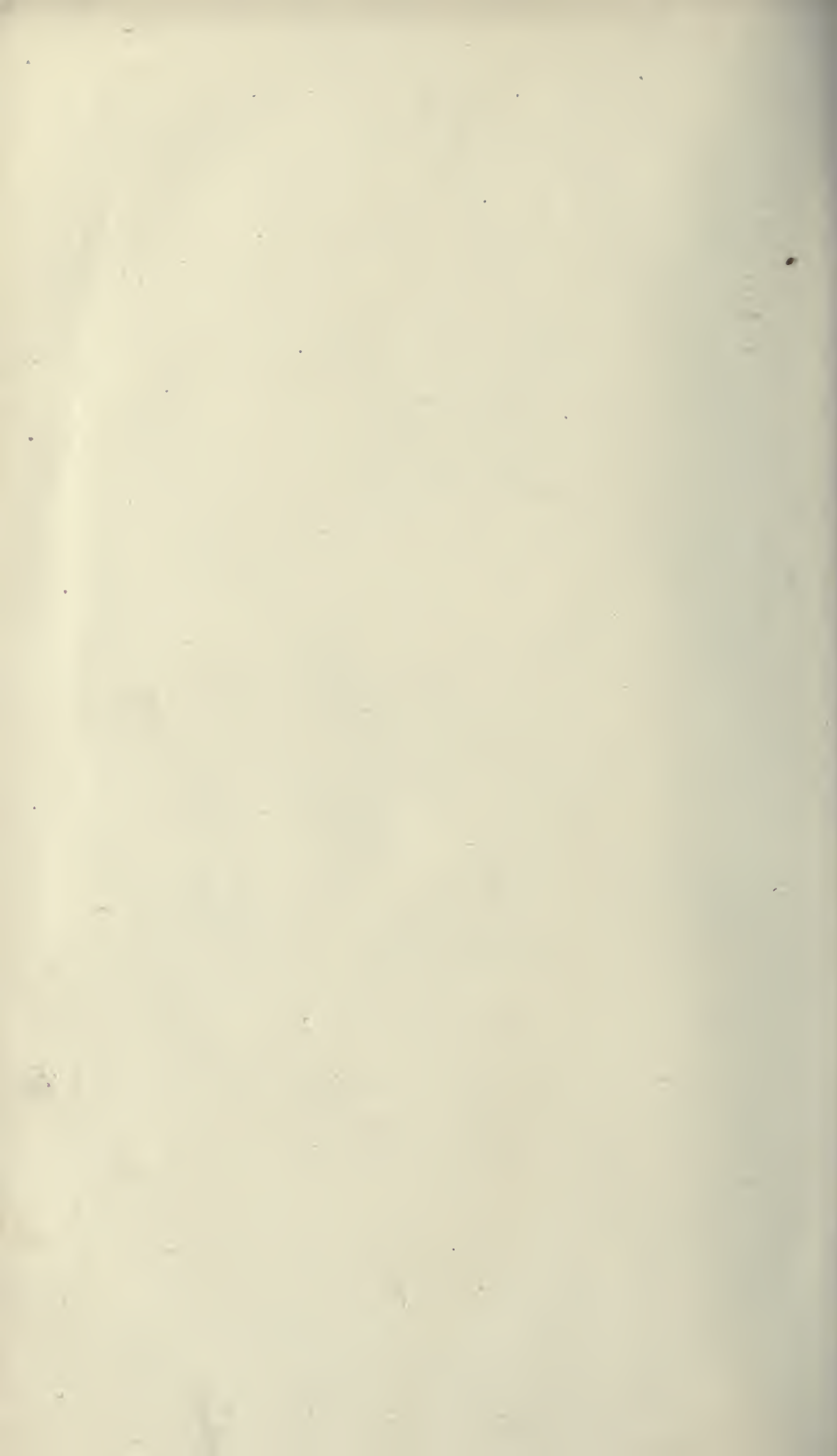




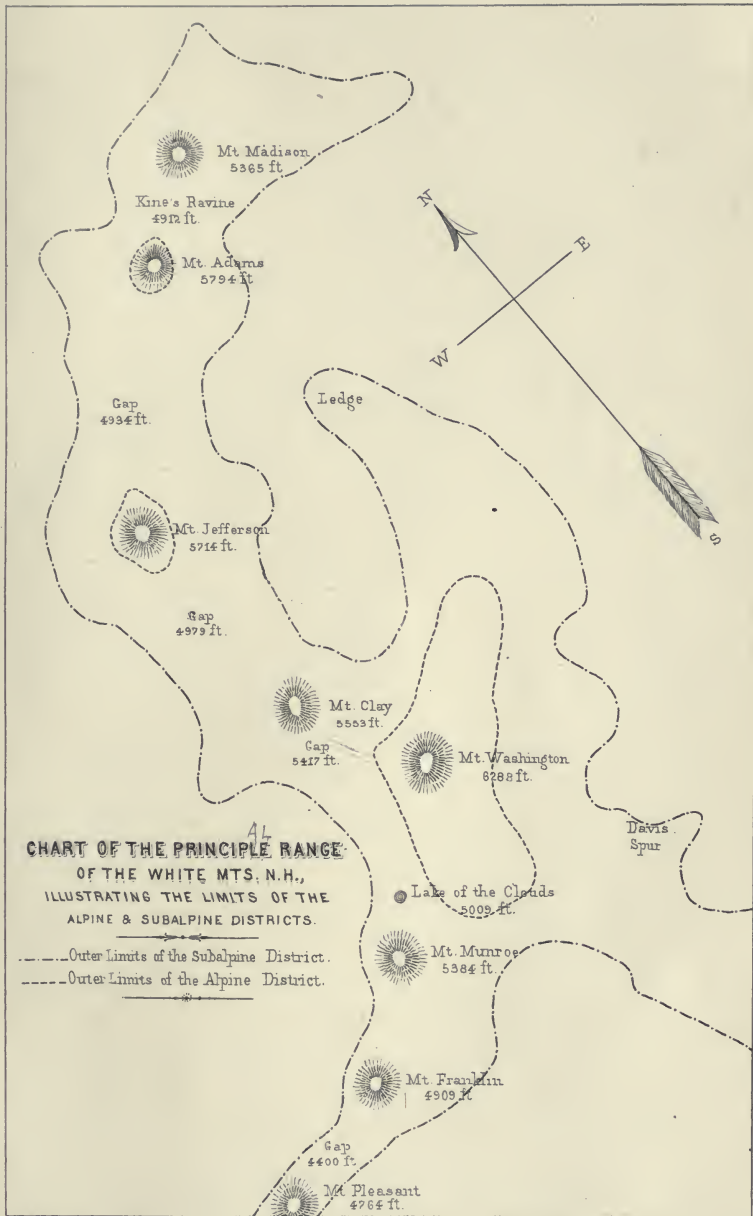
























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